ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

"Of the total of the above costs 80 per cent to 90 per cent is fixed by the original commitments; therefore you will appreciate—it is impossible to vary rates as in other commodities." This true statement of F. A. Gaby of the Hydro-Electric Power Commission of Ontario might well be pondered by politicians in this country.

●

And there is a contrast in the Ontario Hydro way of fixing wholesale rates as compared to the Tennessee Valley Authority. In Ontario rates are fixed by investment and operating charges up to each point of delivery. In Tennessee the 7-mill wholesale rate takes no account of relative proportion of investment, distance, load factor or size of load. It is a regional rate and either the major cities pay out of proportion or the government subsidizes the enterprise. A sad awakening will come to those municipalities which attempt to sell at the specified rates with underground distribution system.

●

One of our friends states that he is doing "sweatshop" engineering at 7 dollars a day and demands that we chastise those who thus treat engineers. Injustice is seldom rectified by scolding. The cessation of construction worked hardships on others than engineers. Verily, even editors suffered.

●

The New York NRA parade — 250,000 in line and 1,500,000 looking on. What a marvelous thing is a circus to arouse emotion and bring about mass action. Engineers and business men sometimes forget this in their endeavor to arrive at a planned and logical national economy.

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ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

September 23, 1933

L. W. W. MORROW, *Editor*

In the Public Interest

IN VIRTUALLY every community agitation for lower utility rates is being pushed vigorously on behalf of consumers. The electric light and power companies are on the spot and what has gone before is literally and figuratively nothing to what lies ahead. Any hope that temporizing or that the action of private utilities alone might meet the situation is definitely dispelled by the current announcement of policy by the Tennessee Valley Authority. The deadly news is out. Energy is to be sold to communities at an average of 7 mills per kw.-hr. and resold to consumer at a specified 3 cent maximum, 2 cent second step, 1 cent third step and with an exceedingly low fourth step of 4 mills. All-electric service for $6.70 a month!

Those same strategic elements of attack which have brought the nation into general acceptance of the possible virtues of NRA are being used again in the establishment of this $106,000,000 "yardstick." Whether or not one accepts the statement that in fixing charges for T.V.A. energy all elements of cost have been included makes little difference. Consumers and their self-appointed spokesmen will soon be quoting the figures and above all the spread of roughly only 2.3 cents between the cost of generation and the cost per kw.-hr. to the lowest-quantity consumer. This T.V.A. announcement is only the first of these engulfing waves; others are in the offing.

The trap has been sprung. There are those who still feel that time in beneficent indulgence will cure all the ills of the industry and that the shrill cries of "Wolf, Wolf," which their fellows voice are but the nightmares of this depression; that there is no wolf there. But here it is; and a very real one, gaunt with hunger and slavering at mouth. You cannot shoot this wolf; it is the administration supported by the public. Informed Washington comment asserts that however radical the administration may appear in some aspects and activities there is no one subject upon which such concerted and inevitably radical action may be looked for as upon the electric light and power industry. The President himself is directing the unhurried and all-but-psychologically-impregnable attack. The campaign, like others in progress, is that of indirection. It is capitalizing upon a hostile public sentiment to inaugurate policies that undoubtedly point to public ownership of light and power utilities. It is time to fight and not to acquiesce in any statement that the public wants lower rates and wants public ownership and therefore it is useless to fight. The public is fair when informed; it changes its opinions. The public will respond now as it has in the past to a leadership that conforms to American principles of business conduct—private initiative and private enterprise.

Action is called for; and called for immediately. This action must be unselfish. Trends have gone too far and conditions have become too serious to approach this problem from the point of view of protecting vested interests. The public as well as all branches of the electrical industry will suffer and not the utilities alone, should present trends develop into their inevitable disastrous conclusions. Make no mistake, this

country will have more expensive and less satisfactory electric service in the future if these policies, originating in high places, are carried out.

What shall be done? We believe this problem is so large and so fundamental to national welfare that it must be approached on the highest plane of competency and unselfishness. *It must be answered upon the ground of public interest only.* Facts must be studied, trends analyzed, policies formulated. A national council should be called. A group composed of public-spirited citizens, utility executives and manufacturing executives of the highest rank could well afford to devote the necessary time and thought to the situation with the aim of making a report to the President, the public and the industry that would be unselfish and authoritative. It is the duty of leaders to lead and to lead intelligently. No intelligent and informed leader can view the present acceptance of false conceptions about public utilities and remain inert and unconcerned. The wolf is at the doorstep already. Why wait to be eaten?

We must have more business

An expanding business is the one road to prosperity for the electrical industry. No codes, no economies, no reorganizations and no talking will succeed in overcoming industry difficulties. Executives should realize that the glittering novelties of the codes, the patriotic dispersion of wealth under the new deal and the unsettled future of the dollar are superficial and scenic handicaps to expanding business. They make a changed environment but they do not create greater revenues. They cause higher wages and higher taxes without compensating purchases.

All this is correct, for it would be naïve for the industry to think that the government will create business or change the fundamental market data or market conditions. Too frequently, however, executive attention is focussed upon the NRA decorations to the detriment of their business. After three years in the red, one would think the manufacturers would take advantage of a partial business revival to sell. In the face of increased taxes and lower rates one would think utility executives would concentrate upon load building. But people are not logical. Marketing and selling is an old drab as contrasted to the youthful and fascinating NIRA. There is little of romance and allure in hard-boiled selling.

Utilities, manufacturers, wholesalers, contractors and retailers in the electrical industry probably were more stable and needed codes less than any other industry group. Bad practices and maladjustments in internal organization were conspicuous by their absence. And no other industry has the marketing opportunity of this group. They have not started to sell their products and services, and present improved conditions favor a very aggressive and comprehensive sales program. For these reasons it is the council of wisdom to concentrate executive attention upon sales and not on codes.

Awake at last

The Washington tailors are now cutting a suit to fit the capital goods industries. They have come to realize that only a 50 per cent and very transient prosperity can come from dressing up the consumer goods industries alone. The new suit takes the form of making money available at low rates with government funds.

Billions of dollars can be used for the modernization of industry. There is an accumulated deficit of at least six billion dollars in needed plant facilities and the estimates are as high as thirty billion dollars as a back-log. This money must be long-term capital to be used. If business picks up the new investment can be written off rapidly, but industrial executives are in no mood to bet on the future.

There are two hard-boiled business inducements that should make the capital goods industries spend money for modernization. The first is that Uncle Sam will provide funds on terms so generous that such a chance to secure cheap money cannot be neglected. The second is that we are headed toward inflation and the dollar will now buy 25 to 50 per cent more rejuvenation than in the next three years.

Add to these tangibles the fact that the manufacturer who now modernizes, who now retools and redesigns, who now cuts costs and improves efficiency through the use of capital equipment will beat out competitors and make the profits when business comes back.

THE WEEK

Electrical Inspectors Report Progress Toward Wiring Safety and Adequacy

"WHILE DEFECTIVE wiring does cause fires which destroy property and life, the loss is insignificant in comparison with what it would be if systematic inspection service did not exist in the majority of our cities and towns." This thought, as stated by George H. Parker, Kentucky Actuarial Bureau, might be taken as the animating theme of the discussions in which nearly six hundred electrical inspectors participated, along with leaders of other branches of the electrical industry, at the meeting of the International Association of Electrical Inspectors held in Chicago last week. The purpose of the meeting as announced by J. C. Forsyth, past-president of the association, was triple: (1) A better understanding of the National Electrical Safety Code by inspectors, (2) aid for inspectors to secure and enforce regulation for adequate wiring, and (3) to create public demand for approved materials and appliances.

An I.A.E.I. advisory service

President N. E. Cannady told them they needed an active committee to handle an investigation and advisory service to members on adequate and sufficiently uniform statutes and ordinances. Told them of the work just beginning on specific study and development of suitable sales control regulation to permit the association to render informational and advisory services to members and urged active work to insure proper qualification of contractors and electrical workmen so that untrained and unpoliced workers will not do short-lived, unsafe work to the detriment of public welfare. The inspectors heard manufacturers, including President J. S. Tritle of N.E.M.A., advocate material of high standards, uniform code legislation and sales control ordinances. It was stated that manufacturers want an intelligent enforcement of the code, want the help of the inspectors in introducing new things and want the inspectors to work with the manufacturers.

E. W. Lloyd, Commonwealth Edison Company, referred to the apparent intention of the government to persecute electric utilties by imposing high taxes and demanding low rates. He said that the merchandising of appliances by utilities should be encouraged rather than obstructed and that such obstruction was not sought by the public, but by specific interests. Mr. Lloyd said that little progress had been made to date in wiring adequacy and that the electrical inspectors could help the public to obtain all the outlets it needs for its fullest service. It was his contention also that people cannot afford to pay present wiring costs, that cheaper methods are now available and will probably be used. Col. William Kelly, Niagara Hudson Power Corporation, stated that the biggest problem of the utilities was that of costs and that to meet the rigorous conditions now being thrust upon them utilities must increase their business greatly. In this effort the intelligent and friendly co-operation of the inspectors would be most useful. B. F. Weadock, Edison Electric Institute, pleaded for simplicity of inspection methods and in the safety code. He spoke from his experience as a lawyer of the tendency of any set of rules always to grow in number and complexity and said that experience shows there is definite limit to the efficacy of such compilations. His idea was that the essence of safety requirements might be contained in a much more simplified code than the present one and that the continued elaboration of safety rules and regulations will ultimately defeat the purpose of the code.

Lack of adequacy of wiring installed in years past has caused the shoddy and unsafe average installation of today, said E. A. Brand, Buffalo, Niagara & Eastern Power Corporation, who went on to demonstrate with facts and figures that the cost of wiring is not proportional to the capacity of the installation. Mr. Brand said that it pays to install sufficient copper in every wiring job and that there is a definite relation between adequacy and safety in wiring. He advised the inspectors that they could best promote safety by promoting adequacy.

Reinspection service urged

Speaking as its president, L. E. Mayer said that the National Electrical Contractors Association was strongly in favor of inspections for all electrical installations. He said that great harm has been done in many cities by the reduction of inspection forces, that bootleg wiring has grown to be a national menace and that strong ordinances based on the electrical safety code, together with adequate inspection, are needed to fight against it. Mr. Mayer stated that the contractors' association was firmly against any letdown or liberalization of the safety code. He spoke of reinspection of old work as a promising field both for the inspector and for the contractor, saying that inspecting of electrical installations is a continuous job and that because an installation is pronounced safe at the time it begins to work is no reason to believe that it will remain safe throughout its life. He asked for enforcement of licensing ordinances and laws as a protection against bootleg wiring. He stated that the contractors are interested in new and economical wiring methods, but are against bare neutral and concentric wiring as of lowered standards.

Resolution protests safety shift

The convention adopted several resolutions, two of them quite significant. In one the I.A.E.I. protested against discontinuance of the work of the Bureau of Standards dealing with safety, stating that such work in the electrical field during the past fifteen years has had a marked effect in the trend of practice and the attention given to the reduction of accidents and that it is considered that such work carried on under other auspices would not have the same influence and effectiveness and freedom from commercial bias, leading thus to the resolution that the I.A.E.I. request the Secretary of Commerce to reconsider the decision to discontinue such work.

The other resolution comprised an invitation to the National Board of Fire Underwriters, the Edison Electric Institute, the National Electrical Manufacturers Association, the National Electrical Contractors Association, the Underwriters Laboratories, Inc., to appoint representatives to work with the inspectors toward a more strict and general enforcement of the intentions and spirit of the electrical code.

T.V.A. Rate Schedule Disrupts Markets

DAVID and Goliath at it again; substituting a yardstick for a slingshot? Measured by the anticipatory shivers in Wall Street, one might look for another one-sided battle of the ages. Utility securities declined sharply. Measured by cold economics David (Lilienthal)'s small, hard stone was more useful in impressing the Israelites than in overthrowing wide-stanced electric service and sounded like clay instead of stone. Possibly it landed in certain municipalities about to vote on purchasing Muscle Shoals energy with peculiar effectiveness. Power or politics? In any event the first stone has been cast.

Following the initial rate announcement (ELECTRICAL WORLD, September 16, page 356) there came a second "suggestion" for residence rates: First 50 kw.-hr., 3 cents each; next 150, 2 cents; next 200, 1 cent; all over 400 kw.-hr., 0.4 cent. Minimum bill (urban): 5-amp. meter, $0.75; 15-amp. meter, $1, and 50-amp. meter, $1.50. Rural co-operatives; 2 to 5 customers per mile, minimum bill $1.20; 5 to 10 per mile, $0.75; and, 10 or more, $0.60. Rural service, municipally contracted, respective minimums, $2.10, $1.50 and $1.05.

As to wholesale rates (1,000 hp. and over) delivered at the secondary side of the substation transformer, main line switch, and transformers to be provided by the Tennessee Valley Authority (Price, $22.50 per hp. per year) there will be: (1) Minimum bill, 50 cents per horsepower, based on the highest of previous eleven months' demand. (2) Bill to be rendered monthly. (3) Demand measured by integrating demand meter with a half-hour interval. (4) Demand meter to be reset monthly. (5) Loads of less than 1,000 hp., if accepted; extra cost of service will be billed extra.

Rate bases explained

Commenting upon the proposed wholesale rates, Director-in-Charge-of-Power Lilienthal announced them to cover all costs of furnishing service and to be based on the board's policy that Muscle Shoals shall be entirely self-supporting and "bankable," in other words, a business enterprise. "The computations," states Mr. Lilienthal, "have been subjected to the criticism of recognized rate experts. The figures show that all costs of service are included and, in addition, provision has been made for items of cost not actually incurred, such as taxes and interest, but which were nevertheless included in order to make fair comparison with privately operated utilities, for 'yardstick' purposes." He continued:

1. *Taxes*—The statute under which we operate provides that a tax of 5 per cent of annual operating revenues derived from power generated in Alabama be paid to that state. When power is available from the new Norris Dam on the Clinch River, taxes will be paid to the State of Tennessee on the same basis. The Authority is subject to no other taxes. But to make fair comparison in our computations we have set up as expense an additional percentage of gross revenues which, with the 5 per cent actually payable, will equal the national average per cent of gross revenues which private electric utilities pay in taxes, local, state and federal.

2. *Property Value*—Obviously there has not been time to make a determination of the "present value" of the property at Muscle Shoals, as required by Congress, or to allocate that value, as the law requires, between navigation, flood control, fertilizer, national defense, and power. An estimated property figure for the hydroelectric property has been used. Since this is a business enterprise we have set up as a basic figure the amount which a business man would be willing to put into a plant at Muscle Shoals, based in part on the cost of similar construction work in recent times. To this figure we have added 25 per cent, to be conservative, since the higher the capital figure, the greater the fixed expenses. In setting up figures applicable to investment in the transmission lines the Authority is beginning to build, we used a careful estimate of costs, checked against recent actual experience.

3. *Interest, and Repayment of Capital to the Treasury*—The Muscle Shoals property was built with funds raised to carry on the war. No obligation is imposed on the Authority to pay interest on that money, as will be the case if and when the Authority issues bonds to pay for additional facilities. But to provide an unquestionably fair comparison with private operations, we have set up hypothetical interest expense at the rate the government would have to pay for such capital. As to the money appropriated by Congress last winter for the construction of transmission lines, likewise no interest payment is required by law, but we are nevertheless setting it up as a hypothetical cost, to insure fairness of comparison with private operation. Retirement of transmission line investment is also provided for, by annual charges against the consumer.

These items of interest and amortization will be available to pay back to the Treasury, and therefore, in a sense to taxpayers all over the country, the sums appropriated from the Treasury. Ultimately this practice will leave the power facilities free and clear of interest obligations. Since privately operated utilities refund rather than retire their capital obligations, this policy of the Authority is in the direction of a more conservative practice.

4. *Depreciation*—An adequate amount has been set up as an expense item to cover wear and tear and obsolescence. This item is probably not necessary to be set up, in view of the Authority's policy of amortizing capital. But it is included to avoid any question of fairness of comparison with private operations, and as an addi-

Boulder Dam Foundations Rising

Wide World

At the rate of 6,000 cu.yd. every 24 hours concrete flows into the forms which daily rise higher above the now dry bed of the Colorado River at the Boulder Dam in Black Canyon. This $165,000,000, 730-ft. high dam and appurtenant works will eventually involve some 4,400,000 cu.yd. of concrete before completion. Roughly, 100 ft. by 100 ft. by 2¼ miles is an equivalent volume measure.

tional measure of conservative financial practice.

5. *Operation and Maintenance*—On these items we have experience data on the Muscle Shoals plant. Economies and improvements will doubtless be made to cut down the figure, but no allowance for such economies has been made in the computations.

6. *The Market*—The prospective volume of business is of course a basic factor in setting a selling price in a new business venture, where no market has yet been attached. In these computations we have leaned to the conservative side. The figure must of necessity be an estimate, since at the present time almost the entire market in the Valley is occupied by private utilities. To be conservative, the estimate of volume of business is on the basis of primary power; i.e., power available through the entire year. Yet the Authority has available some 500,000,000 kilowatts of secondary power, much of which can be sold at a reasonble price.

It is unreasonable to anticipate that the volume of business will immediately be adequate to carry the full costs. In any business there is a development period, and we have taken this factor into account in our computations, particularly since we begin operations with a huge plant on which we are accepting fixed charges.

Two factors will probably shorten this development period materially: the low rates proposed will probably (a) give the Authority a fair market, and (b) result in greatly increased demand for electricity.

The proposed rates to be charged the householder and farmer by the municipalities were similarly based upon estimated costs. A substantial and conservative spread between the price of transmitted current sold by the Authority and the price proposed to be charged the ultimate consumer was suggested.

"I think it should be understood," Mr. Lilienthal stated engagingly, "that nothing in our program is punitive. We do not intend to confiscate anybody's property without due return for the investment, neither do we intend to deal unfairly with any interest. Public competition in the past has meant neither death nor disaster to private companies. They usually have found that they can adjust themselves to the competition of the public agency.

"I think it is inevitable that in such a development the private power companies will be benefited, as other interests will be, by the growth of wealth. If this valley is developed as President Roosevelt's plan provides, everybody will benefit."

▼

Federal Aid on White River Dam

Efforts to interest the government in financing the building of Tablerock Dam on the White River as a public works project because of its flood control value are being made by the Springfield (Mo.) Chamber of Commerce and officers of the Doherty interests in that state. William H. Swift, Jr., vice-president and general manager of the Springfield Gas & Electric Company, a Cities Service property, stated following a conference with representatives of the Springfield chamber that local civic leaders feel if they could get the backing of the federal government Henry L. Doherty & Company would be glad to go ahead with the Tablerock project. The federal Public Works Board will be asked to contribute 30 per cent and lend 70 per cent toward the $30,000,000 estimated cost of the dam's construction.

▼

Inflation Pressure Returns

Agricultural advocates of currency inflation, largely from Southern states, have besieged official Washington with delegations, telegrams and documents for the past week or ten days in pleas for immediate action to further, and swiftly, boost commodity prices. News of community mass meetings and polls of Washington-absent Congressmen have led to further fears that President Roosevelt might exercise the powers already granted him in this connection.

Wall Street experienced an exceedingly bad case of the jitters this week and as the dollar slumped to new lows in foreign exchange financial markets reacted. High-grade bonds off (increased Federal Reserve Bank buying sustained government issues); stocks first declining, then rallying, showed resistance to inflation rumors in all except relatively few issues which made new highs for the year. Speculators appeared unable to balance fear of capital losses against unlikely industrial earnings in their market operations.

Figures of the week broadly negative, even allowing for holiday effects. Steel output between 40 and 44 per cent of capacity, or June levels. Carloadings off 14.3 per cent from previous week, back at June levels. Lumber production holds mid-1931 levels. Credit velocity in August was 18 per cent slower than in July and 2.5 per cent below August last year. Chain food store dollar sales decline more than sales volumes, showing buyer resistance to increased prices. Bituminous coal production down. Manufacturers report collections against wholesalers to be slowing down; wholesalers are carrying retailers' accounts longer. On the up side there are—commodity prices notably strong in speculative buying and energy output at year's peak.

The anticipated October crisis is not likely to be far off schedule; it may even be ahead of time.

Samuel Insull's Dossier Makes Larger Volume

One version in Greek, an English translation and four photostatic copies of the Insull dossier have been prepared by the first secretary of the United States Legation and deposited with the Greek Foreign Ministry in Athens. Each copy consists of 1,080 pages, divided in four volumes, a total of twenty-four.

"We have been put to no little trouble and expense to facilitate the task of the Greek authorities," states Leland Morris, United States Chargé d'Affaires in Athens, "and have even had a bookbinder kept specially employed punching and sewing up the copies, including the Greek original prepared in Washington."

Details of the dossier have, according to Mr. Insull, been refused his counsel.

NRA will succeed provided that industry can operate at a profit. It can work if men are fair. It can work if labor is fair. It can work if industry is fair. It can work if government is fair.

FLOYD L. CARLISLE
Chairman
Niagara Hudson Power Corp.

Mr. Carlisle this week addressed the Electrical Association of New York prior to the opening of the National Electrical Exposition.

Range Rentals Offered Alabama Power Customers

Joining the growing ranks of utilities offering ranges, and in some cases other heavy-duty appliances, on a rental basis the Alabama Power Company has announced a rental plan for 500 electric ranges and 250 electric water heaters for those who "wish to judge Alabama's new low-cost electricity for themselves in their own homes."

Customers agree to pay a monthly rental for the appliances amounting to $2 for the first year for the range and $1.45 for the first year for the heater, with diminishing amounts over a five-year period. If the customer decides to buy the appliance 60 per cent of the rental paid is allowed on the purchase price. He has the other alternative of continuing to pay rent or he may at his discretion have the power company remove the range or heater.

▼

Maine Tax Plan Fails

By nearly a two to one majority Maine last week turned down in a general election the proposed state franchise tax of 2 per cent on the gross operating revenue from the sale of electricity and the proposed 2½ mills per dollar tax on the value of intangible personal property.

▼

Federal Trade Hearings

Familiar testimony as to write-ups and mergers recurred in the resumption of Federal Trade Commissions hearings last week. W. S. Barstow & Company affairs came under review, as did related activities of the Associated Gas & Electric system.

Coming Meetings

National Electrical Manufacturers' Association—Cleveland, Ohio, September 25-28. A. W. Berresford, 155 East 44th Street, New York.

National Electrical Exposition — New York, N. Y., September 20-30. Ralph Neumuller, 480 Lexington Ave., New York.

American Welding Society—Detroit, Mich., October 2-6. M. M. Kelly, 29 West 39th St., New York.

National Safety Congress, Public utilities section—Chicago, Ill., October 2-6. C. B. Boulet, Wisconsin Public Service Corporation, Milwaukee, Wis.

National Association of Railroad and Utilities Commissioners — Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

▼

Federal Trade Commissioner Refuses to Resign Office

Maintaining the Federal Trade Commission to be a continuing and independent body not under Presidential control, William E. Humphrey, Republican member, has refused to accede to the request of President Roosevelt for his resignation. Mr. Roosevelt took the position that, while another Republican would have to be appointed to fill the place, his administration policies with respect to the Trade Commission could be achieved better through one of his own appointees. Instead of resigning Mr. Humphrey wrote the President that the organic law creating the commission permitted removal of a commissioner only for wrongdoing or inefficiency. Neither of these grounds has been cited by the President in connection with Mr. Humphrey, who was appointed to the commission in 1925 by President Coolidge and reappointed in 1931 by President Hoover.

In contending that President Roosevelt had no authority to remove him, Mr. Humphrey has raised the question as to the presidential power to remove at will any members of independent federal commissions who have been confirmed by the Senate.

▼

Extradition Appeal Denied Martin Insull in Canada

In a ruling handed down last week Justice W. H. Wright of Toronto dismissed a motion on behalf of Martin J. Insull for leave to appeal against a judgment of Justice K. C. Kingstone declining to appoint a commission to go to Chicago to examine certain witnesses upon questions relating to the effort of Cook County, Illinois, to have Mr. Insull extradited from Canada to face charges of embezzlement in Chicago. "I am strongly of the opinion," said Justice Wright, "that no appeal lies and on that ground alone the application should be refused. I regret that I have to come to that conclusion, because the matter is of such importance. Justice Wright added that he knew of no provision of law which permitted him to refer to the Court of Appeals the question raised by the application on behalf of Mr. Insull.

During the week James T. Woodward, chairman of the protective committee for general lien and collateral trust 5½ per cent bonds of the Northeastern Public Service Company, notified holders that the Chemical Bank & Trust Company has agreed to take no action in furtherance of foreclosure proceedings under the first lien bonds, all of which are owned by the bank, pending presentation of a reorganization plan by the general lien bondholders' committee.

▼

Arcless Performance of Industrial Contactors

Without introducing mechanical devices to suppress the arc it is possible to speed a.c. arc extinctions with a simple, rugged, single-break type of contactor by inclusion of an "arc arrester." A recent development by Westinghouse for mounting on the base of a contactor or linestarter involves a small unit consisting of a small capacitor and resistor connected across the poles on the load side of the contacting device.

Effectiveness of the development is said to be startling. Oscillograms show less than one-half cycle arcing with the arc arrester as against a persistence of five to eight half cycles under otherwise identical conditions without it. This example involved tests at 550 volts, 60 cycles with a 7½-hp. motor, rotor locked, as load.

In practical installations but one unit is required for a three-phase contactor and relief is afforded not only for the contactor, or linestarter upon which it is mounted, but also for any disconnect, operating switch, fuse or other rupturing device connected ahead of the contactor. On three-phase reversing service but one "arc arrester" is required as it acts with equal effectiveness to relieve either the forward or reversing contactor.

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Unemployed Sell Lamps

Nebraska Power Company has taken 40 men from Omaha's list of the unemployed and set them out on a two months' house-to-house canvass to sell lamps. Newspaper ads advise the public of the project and urge purchase from these armband-identified lamp men of the winter's supply of lamps, adding: "These lamps will be purchased from your neighborhood dealer and charged on your next electric service bill."

Indiana Commission No Longer Self-Supporting

For the first time since the Indiana Public Service Commission was formed, the six-months period just passed has demonstrated this regulatory body to have ceased being self-supporting. Indiana utilities are required to pay fees for filing cases, for hearings and a percentage upon all new bond issues. In the last year there have been no petitions for rate increases, hearings at utility behest have been minimized and new financing was at a standstill.

So acute have finances become that Governor Paul V. McNutt, elected on a platform of public utility rate reduction, has stated that money from his emergency contingent fund may have to be advanced to meet operating costs of the commission before the end of the fiscal year. All this in spite of the fact that the last legislature cut salaries from $145,000 to $100,000.

The rotary fund is being depleted, no receipts have been directed to it since July 1 and the fund has dropped nearly a third and promises to become extinct unless utilities begin building it up through payments for cases, hearings and bond issues.

Paradoxically enough, commission activity is most brisk. In the last six months three commissioners have been in office, instead of the previous five, which number constituted former commissions; the cases on the docket have been reduced from 1,686 to 1,206. Scores of hearings have been set and the average hearings a day will be around five, with as many as ten having been heard in a single day. The present commission has received 1,098 new cases in the last six months.

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NRA Industry Codes in Unchanged Status

Though hearings have been completed on the electrical contracting industry code no approval has yet been made by President Roosevelt. Testimony presented at the hearings last week is to be assembled and analyzed for the master construction industry code and supplementary codes, of which electrical contracting is one.

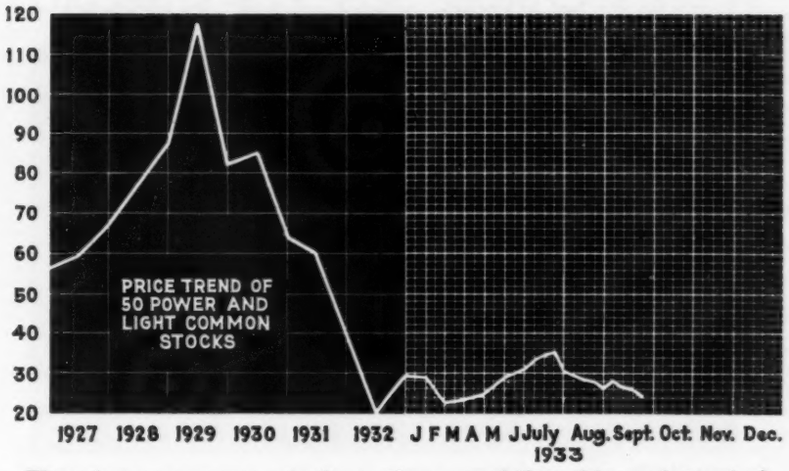
Other codes related to the electrical industry have been submitted on behalf of the electrical protection industry, incandescent electric lamp manufacturing industry (Incandescent Lamp Manufacturers' Association) central-station electric protective industry (Central Station Electric Protective Association) and electrical and mechanical service industry (National Industrial Service Association). No other code activities have taken place this week.

Preferred Dividends Off for Engineers Public Service

Directors of Engineers Public Service Company have voted to defer dividends payable October 1 on three series of preferred stock.

C. W. Kellogg, president, in an official statement last week pointed out: "The earnings of the parent company for the first three-quarters of this year will cover the preferred dividends by a small margin. On the other hand, aggregate current earnings of subsidiaries both gross and net are still falling below the corresponding period of the preceding year and this, together with the Federal tax on electric energy beginning Sept. 1 and the increase in expenses required to comply with the provisions of the NRA code, will prevent the earnings of the full preferred dividends until business improves. Under these conditions the directors believe they should defer the preferred dividends and conserve cash."

Sharp Drop in Utility Stocks



Though many common stocks on the general lists this week touched highs for the year, those of utilities, as indicated by the "Electrical World" average, slumped to the lowest point since April, 23.8. Last week, 26.3. T.V.A. rate reaction a factor.

Doherty Men Organize New Securities Company

In accordance with the announcement made last month by Henry L. Doherty & Company that an independent company would be organized by former employees to handle the distribution of securities (ELECTRICAL WORLD, August 5, page 165), Alpha Distributors, Inc., has been formed to deal in securities of every kind. The major portion of the business of the new company will be distribution of securities through its own branch offices, which were the retail securities offices of Doherty & Company. The company also contemplates inviting established security dealers and others to participate in the sale of investments. R. C. Russum is president and S. B. Irelan is first vice-president and general manager. The principal offices will be at 60 Wall Street, New York, and as soon as the company has been qualified in the several states it will have branch offices in 25 cities.

Prior to the passage of the new securities act, Doherty & Company had withdrawn an application for a new license to do business in West Virginia, being unwilling to comply with certain new state security regulations (ELECTRICAL WORLD, July 15, page 68). Last year the sale of Cities Service securities had been banned in the state of Kansas, although later the ban was raised under a temporary permit issued by the Kansas Charter Board (ELECTRICAL WORLD, March 18, page 344, and March 25, page 376).

Winnipeg Electric to Default

President Edward Anderson of the Winnipeg Electric Company announced late last week that, "It is with very great regret that owing to the depression of the past few years, which still continues and has resulted in largely decreased earnings, directors of Winnipeg Electric Co. consider the present financial position of the company does not justify payment of interest due October 2 on the 5 per cent refunding mortgage stock payable in sterling and the 6 per cent refunding mortgage bonds, as resources are already inadequate for requirements. Negotiations are in progress looking to complete reorganization of financial structure of Winnipeg Electric and allied companies."

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

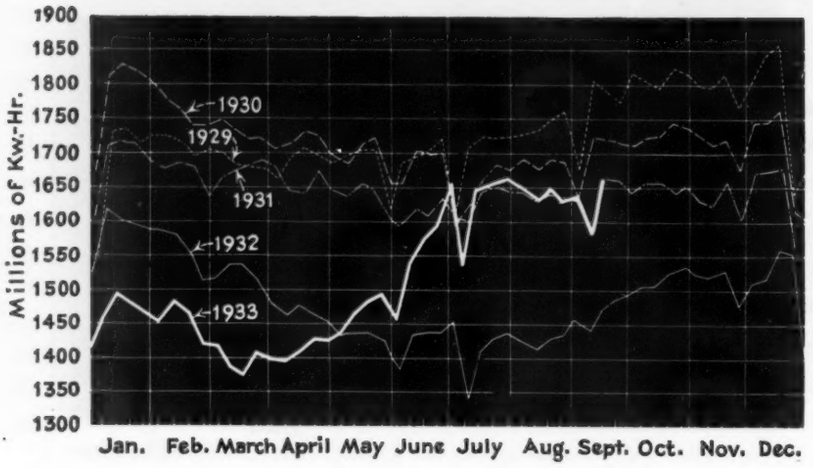
	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Duquesne Light (Year ended July 31)					
Gross earnings	$23,801,942	$26,406,912	— 9.8	43	43
Net earnings	13,513,036	15,128,812	— 10.7	..	..
Net balance*	10,967,596	12,779,757	— 14.2	..	..
Northern States Power (Del.) (Year ended July 31)					
Gross earnings	31,152,443	33,343,614	— 6.6	60	58
Net earnings	12,361,914	14,106,921	— 12.4	..	..
Net balance*	6,435,613	8,263,707	— 5.5	..	..
Puget Sound Power & Light (Year ended July 31)					
Gross earnings	12,682,761	14,470,503	— 12.4	62	61
Net earnings	4,850,857	5,666,396	— 14.4	..	..
Net balance	509,973†	741,800	—169.0	..	..
Virginia Electric & Power (Year ended July 31)					
Gross earnings	14,729,213	16,149,350	— 8.8	64	66
Net earnings	5,325,843	5,577,961	— 4.5	..	..
Net balance	2,245,136	2,536,578	— 11.5	..	..

Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Continental Gas & Electric and subsidiaries (Year ended July 31)					
Gross earnings	$30,579,914	$30,929,583	— 1.1	66	64
Net balance	1,207,166	2,740,521	— 55.9	..	..
Engineers Public Service and constituent cos. (Year ended July 31)					
Gross earnings	43,240,702	48,961,313	— 11.7	65	64
Net balance	522,670	2,941,039	— 81.8	..	..
Philadelphia Company and subsidiaries (Year ended July 31)					
Gross earnings	45,542,730	52,224,576	— 12.8	66	65
Net balance*	7,276,488	10,731,637	— 32.2	..	..
United Light & Power and subsidiaries (Year ended July 31)					
Gross earnings	73,959,959	82,653,729	— 11.5	69	68
Net balance	1,361,425†	2,567,760	—153.0	..	..

*Available for all dividends. †Deficit.
Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

Week's Output Sets Year's Record



Central-station output for the week ended September 16, announced by the Edison Electric Institute as 1,663,212,000 kw.-hr., exceeded by a small margin the previous high for the year, attained in the last week of July. As in the recent past, production continues almost identical in amount with that of corresponding weeks in 1931. The gain over the same week in 1932 increased to 12.7 per cent; the increase compared with the week of Labor Day was greater than last year.

Regionally the Mountain States and the Central industrial area continue to report the largest gains. The Middle Atlantic, West Central and Southern States also show higher percentages than in the preceding week.

Weekly Output, Millions of Kw.-Hr.

1933	1932	1931
Sept. 16.. 1,663	Sept. 17.. 1,476	Sept. 19.. 1,663
Sept. 9.. 1,583	Sept. 10.. 1,424	Sept. 12.. 1,582
Sept. 2.. 1,637	Sept. 3.. 1,465	Sept. 5.. 1,636
Aug. 26.. 1,630	Aug. 27.. 1,436	Aug. 29.. 1,638
Aug. 19.. 1,650	Aug. 20.. 1,432	Aug. 22.. 1,643

Per Cent Change from Previous Year

Region	Week ended Sept. 16	Sept. 9	Sept. 2
New England	+ 9.5	+10.7	+12.7
Middle Atlantic	+ 9.3	+ 7.7	+ 6.8
Central industrial	+17.9	+16.2	+17.4
West Central	+ 6.9	+ 3.7	+ 1.9
Southern States	+10.7	+ 8.4	+ 9.9
Rocky Mountain	+27.6	+26.7	+23.1
Pacific Coast	+ 1.2	+ 2.6	+ 5.0
United States	+12.7	+11.1	+11.8

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Japanese Power Expansion

Because of a marked increase in demand for electric power and as prevailing construction costs are unusually low, seven large Japanese power companies have inaugurated plans for new power plants to have an aggregate capacity of 233,550 kw., according to advices to the U. S. Commerce Department. As first submitted to the Government authorities for approval, the power companies' plans called for new plant construction to generate 423,000 kilowatts. Because of doubt as to whether the present demand for electricity would continue, however, less than half of the schemes put forward were sanctioned.

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Utilities Maintain Credit

Although obligations of domestic corporations maturing in the first six months of 1933 totaled approximately $575,000,000, the financing of these corporations through the offering of securities to the public amounted to a little more than $200,000,000, about three-fourths of which was for refunding purposes, according to R. H. Van Deusen of Stone & Webster & Blodget, Inc. A detailed analysis of the larger issues shows that 47.4 per cent were paid on maturity, 27.4 per cent were extended or exchanged for new securities and 25.2 per cent were defaulted. The utilities made the best showing in maintaining their credit, having met a larger proportion of their total maturities and having defaulted on a substantially smaller proportion than the other groups. They paid 57.9 per cent, as compared with 27.2 per cent for industrials and 46.3 for railroads, and defaulted on 20.8 per cent as compared with 34.8 for industrials and 25.1 per cent for railroads.

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Wholesale Energy Rises 30 Per Cent Over 1932

Large light and power customers increased their use of electrical energy in July by 150,000,000 kw.-hr. over June and by 760,000,000 over July of last year. The increase amounts to 5 and 30 per cent, respectively, and accounts for most of the change in total output. Domestic use was slightly less than in June, but was 1.5 per cent greater than a year ago. Total revenue from ultimate consumers was virtually the same as in June and 1.6 per cent greater than for the corresponding month last year.

As announced by the Edison Electric Institute energy sales (in millions of kw.-hr.) to ultimate consumers and the per cent change compared with July, 1932, were as follows:

Domestic	866.9	+ 1.5
Commercial, small light and power	1,013.2	+ 0.6
Commercial, large light and power	3,309.8	+29.8
Municipal street lighting	150.3	— 7.6
Railroads, street & interurban	301.7	— 2.4
Railroads, electrified steam	56.1	+38.6
Municipal & miscellaneous	61.9	+33.1
Total sales to ultimate consumers	5,759.9	+15.9

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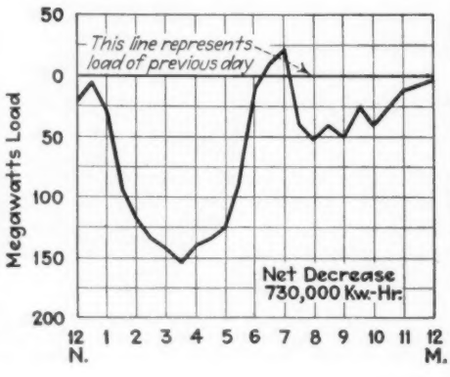
Twin-Filament Street Lights

Following experiments with extinguishing some lamps, using multiple clusters and with several lamp installations on the same standard, all in an endeavor

When New York Stopped for the NRA

According to engineers of the electric companies affiliated with the Consolidated Gas Company of New York the NRA parade on Wednesday afternoon, September 13, cost those companies $36,500 in decreased sales of electricity, if figured at 5 cents a kilowatt-hour. The decrease in the load from that of the preceding day was 730,000 kw.-hr. The drop in load extended from 1:30 p.m. to beyond midnight, with a slight rise above that of the preceding day of about an hour's duration from 6:15 to 7:15 p.m. This rise reached a peak of about 22 kw. above the preceding day's load. The drop reached its lowest point at 3:30 p.m., when it was 155,000 kw. under the load of the preceding day. The chart shows deviations from that day.



to reduce street-lighting costs in late night hours, Paris, France, has turned to twin-filament, high-frequency, remote-controlled, gas-filled incandescent lamps. The most widely used type has 200- and 500-watt filaments inclosed in a 500-watt size bulb.

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Municipal Plant Sold; Taxes Argued in Utah

To the Utah Supreme Court has gone the vexing question of whether the owner of a title-retaining note or the person in possession of the property covered by it must pay the tax. A writ of review has been issued by the court against the state tax commission, directing that body to deliver to the court the record of the proceedings before it with regard to the assessment of the property of the Southern Utah Power Company in Kane County.

The writ was issued on petition of the county commissioners of Kane County, whose action was overruled by the tax commission. The plant in question was built for Kanab city by the Fairbanks Morse Company, which took a title-retaining note. After operating it for three years, during which the plant, as a municipal enterprise, was not assessed, the city sold the plant to the power company. When the assessor came to place a value on the property, he found that the title remained with the Fairbanks Morse Company and its successors in interest to whom the note had been sold.

Accordingly, taxes for four years were assessed against the titleholder, and the county commissioners upheld this action of the assessor.

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$135,000,000 Grid Completed in Britain

This month Great Britain's national transmission scheme, undertaken by the British Central Electricity Board and 5½ years in building at a cost of £27,000,000, was completed. Last link in the overhead network supported by 26,265 towers and covering the length and breadth of the country was that at Fordingbridge, on the outskirts of the New Forest.

The completed project gave employment, directly and indirectly, to more than 200,000 workers. There are 4,000 miles of transmission lines, 2,894 miles operating at 132,000 volts, the remainder at 33,000 and 66,000 volts.

The system has been split up into nine main areas, and the tower with which the network has been completed is in the South-West of England scheme. The Thames crossing towers at Dagenham are 487 ft. high and are among the largest of their type in the world. Outdoor, 132,000 volt metal-clad switchgear is used at Tongland, Scotland, and 75,000 kva. transformers are installed in the Clarence Dock substation, near Liverpool.

There are 273 transforming and switching stations in the grid with a transforming capacity of 11,000,000 horse-power. About 2,500 miles of the network are in operation at present. Towards the end of 1934 probably the whole system will be in operation, carrying a wholesale supply of power to almost every corner of the United Kingdom.

It is estimated that the grids will be loaded to the extent of 70 per cent in 1935 and fully loaded in 1940, when the output of current will be 25,000,000,000 kw.-hr.

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Commission Jurisdiction Over Affiliates' Contracts?

Application by the Chicago District Pipeline Company to the Federal District Court in Chicago for an injunction to restrain the enforcement of a rate reduction ordered last June by the Illinois Commerce Commission brings to the fore the question of commission jurisdiction over contracts between a utility and a non-utility where the ownership relation is much less than 100 per cent.

In the case in question, Peoples Gas, Light & Coke, Public Service of Northern Illinois, and Western United Gas & Electric companies buy their natural gas at wholesale from Chicago District Pipeline Company, which in turn buys it from the Natural Gas Pipeline Company of America, owner and operator of the pipeline. Through a subsidiary the three foregoing operating utilities own the Chicago District Pipeline Company 100 per cent and also have a 26.63 per cent ownership in the Natural Gas Pipeline Company of America. The balance of more than 73 per cent is owned by five other companies.

The commission ordered a reduction by the Chicago District Pipeline Company of the rates it charged the operating utilities, setting a price considerably lower than the existing contract price. Such a reduction the District company contends would amount to confiscation of property.

The question may be stated as, "Where there is some affiliation of interest, but only of a minority nature, must the commission accept as part of the operating expenses of a utility under its jurisdiction the payments which it makes under contract to a non-utility doing an interstate business and which is therefore not under its jurisdiction?"

In two previous cases before the state supreme court where the degree of affiliation between parties was practically 100 per cent it has been held that the commission might with propriety examine prices, the legal rule of principal and agent being applicable.

Major New Construction This Week

Southern California Edison Company plans three-wire transmission line at Newport Beach, Calif., including line over Newport Bay Channel.

Transformers, motors, refrigerating machinery, hoists, conveyors, etc., will be required for waterfront terminal to be constructed by city of Savannah, Ga. A $2,800,000 project.

Interboro Beverage Corporation, Brooklyn, N. Y., plans $500,000 bottling plant.

Commercial Malt Company, Detroit, Mich., plans $500,000 plant in River Rouge district.

Appropriation of $575,000 has been authorized for extensions and improvements in power plant at Naval Academy, Annapolis, Md., and bids will soon be asked by Bureau of Yards and Docks, Navy Department, Washington, D. C.

Motors, pumps, hoists, automatic lifts, regulators, etc., will be installed in service building of Pershing Square Garage Company, Los Angeles, Calif. A $2,000,000 project.

Knoxville, Tenn., is considering construction of city-owned power transmission and distribution system to cost $4,367,000, with power substations, switching stations and other line structures, securing power from Tennessee Valley Authority. Proposition before voters at coming November election.

Until October 9, bids will be received by Public Works Officer, Navy Yard, Puget Sound, Wash., for $1,350,000 electrical and machinery shop (Specifications 7338). Apropriation authorized.

Tide Water Power Company, Wilmington, D. C., will rebuild 17-mile transmission line at Carolina Beach and vicinity and construct a substation, for industrial power service.

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Westinghouse Handles Bermico

Arrangements have been made with Westinghouse Electric Supply Company by the Brown Company of Portland, Me., for the former to handle Bermico conduit sales exclusively. Further strength is said to be afforded the product by the addition of "Solka," a cellulose material, to the fiber conduit.

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New York Metal Prices

	Sept. 12, 1933 Cents per Pound	Sept. 19, 1933 Cents per Pound
Copper, electrolytic	9.00	9.00
Lead, Am. S. & R. price	4.50	4.50
Antimony	6.75	6.75
Nickel ingot	35.00	35.00
Zinc, spot	5.02	5.12
Tin, Straits	45.125	48.00
Aluminum, 99 per cent	23.30	23.30

As to Rates——

• Detroit Edison Company's petition for an order restraining the state utilities commission from enforcing a rate cut order has been upheld by Circuit Judge Leland W. Carr, Lansing, Mich. Attorney General Patrick H. O'Brien had filed a petition for dismissal of the company's petition. An appeal to the Michigan Supreme Court is expected to be made. A temporary order issued by Judge Carr recently prevents the commission from putting its $1,500,000 yearly rate cut order into effect (ELECTRICAL WORLD, Sept. 2, page 298). The commission has accepted an $800,000 reduction offered commercial consumers independently of the commission's order.

• Union Gas & Electric Company's new electric rate ordinance presented to the Cincinnati (Ohio) Council last week, has been referred to the committee for public hearings and negotiations with the company. Council's Public Utilities Committee has recommended for passage by Council an emergency ordinance which would continue indefinitely the present rates. Julian A. Pollak, chairman of the committee, said these rates would be continued until the new ordinance is adopted by Council and becomes effective.

• Missouri Public Service Commission has announced that reductions in utility rates since June 1 under new schedules filed or reported to the commission will make an annual saving of $1,817,506 to Missouri consumers. J. C. Collet, chairman, said most of the reductions have been made voluntarily by the utility companies, following conferences with the commission. A major reduction was reported by the Union Electric Light & Power Company of St. Louis (ELECTRICAL WORLD, Sept. 2, page 298). Reductions of $1,724,576 were made by electric light and power, gas and water companies, telephone reductions making up the balance of $92,930.

Indiana rate negotiations

• Petition of Sherman Minton, public counsellor for the Indiana Public Service Commission, to require the Public Service Company of Indiana to show cause why its rates should not be lowered, has been set for September 25. The action is one of the most widespread ever filed in Indiana. John N. Shannahan, president of the company, has asked for a further delay in an attempt to establish compromise rates. He asserted the company was in no better position to plan for the future than a month ago when the commission heard a report of the difficulties in the way of such a compromise. Perry McCart, chairman of the commission, however, stated that there had been no "honest effort" to reach an agreement on a reduced schedule since the petition was filed last June and that it was self-evident there was no intent to work out a compromise "around the table," as had been suggested by the commission in an effort to avoid a formal hearing.

Other Indiana companies which recently have reduced rates are the Southeastern Indiana Power Company and the Laporte Gas & Electric Company. The municipally owned electric plant at Washington has requested the commission for authority to lower its kilowatt hour rate from 7 to 5 cents.

• Quebec Power Company should reduce its rates for the sale of electrical energy in the city of Quebec so that its fair revenue a year would approximate $1,316,996, instead of $1,660,624, which was its revenue for 1932, according to a report made public by a Commission of Enquiry. At the same time members of the commission strongly advise the city not to try securing reduction of rates by municipalization, as the wisdom of such an investment is more than doubtful. A comparative table of figures computed in the report reveals that the reduction in rates to which the customers of the company are entitled amounts to 20.7 per cent of the present revenue. The rate schedules proposed would reduce cost of residential service by 26 per cent; commercial service 23 per cent; industrial service 9 per cent and street lighting 36 per cent. When differences arose between the power company and the Quebec City Council, the company suggested that it would lower its rate under a schedule that would remain in effect until 1935.

• Consolidated Gas Company's electric subsidiaries were directed last week by the New York Public Service Commission to show the actual cost and details of the employment of 250 of the 2,100 additional employees contemplated by the code under which the seven companies are operating. During examination Frank E. Carstarphen, Assistant Corporation Counsel, established through Robert B. Grove, vice-president New York Edison Company, that there were 351 fewer employees on August 12, when the code became effective, than on May 13. He estimated the saving to the companies at $351,000 annually. Mr. Grove gave a revised computation of the average weekly pay of the 2,100 additional employees as $33.18. He said the cost of overtime work had been deducted in estimating the cost at $3,495,000 for the new employees.

• Public Service Electric & Gas Company won a point last week at the rate hearings resumed before the New Jersey Public Utilities Commission when an effort by a group seeking lower rates to put into the record information regarding tax bills paid by Public Service on its real estate failed. The commission ruled that such information should have no evidential value in the case. Representatives of the Utility Users' Protective League of New Jersey argued that the company should furnish its tax bills and assessments as a relevant fact in the present inquiry. President Joseph F. Autenrieth of the commission, after consultation with his colleagues, declared the commission did not believe that bringing out information regarding assessments would aid in indicating the value of property. It was shown that Public Service Electric & Gas in 1929 paid dividends of 13.3 per cent on the face value of its common stock; that in 1930 the dividends were 21.6 per cent and in 1931 and 1932 approximately 15 per cent.

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Municipal Items

BESSEMER, ALA.—At a mass meeting held last week a resolution calling upon the City Council to adopt at once an ordinance providing for an election on the question of municipal ownership was adopted.

ATLANTA, GA.—City Council has appointed a commission to consider the possible advantages of public ownership of electric utilities. The commission is to consider the question of obtaining power for the municipality from the Tennessee Valley-Muscle Shoals development.

RAPID CITY, S. D.—By a vote of 1,330 to 1,046 citizens have defeated in a special election a proposal to bond the city for the construction of a municipal lighting and power plant in the sum of $596,000. City commissioners had approved the bond issue (ELECTRICAL WORLD, Sept. 9, page 331).

KNOXVILLE, TENN.—Voters are to be asked November 11 to ratify or reject an ordinance which will permit city council to issue bonds to the amount of $4,367,000, the sum set up by city council's power committee as the maximum cost of constructing an electrical power distribution system in this city.

WINCHESTER, VA.—Efforts are to be renewed in city council to petition the Corporation Court to call a special election for the purpose of deciding the question of installing a municipal electric power plant. Citizens will be asked to vote on two proposals, the first involving the supplying of electrical energy for all purposes and the second the generating of power for municipal purposes only. Advocates of a municipal electric plant contend that prices charged by the Northern Virginia Power Company, a subsidiary of the Potomac Edison System, are considerably in excess of production costs at many municipal plants.

MOBERLY, MO.—Formal application

has been filed for a grant and loan under the national industrial recovery act with the state advisory board to finance the construction of a municipal power plant and distribution system estimated to cost $700,000.

CARUTHERSVILLE, MO.—At the special election held September 12 a municipal bond issue of $210,000 to finance the construction of a municipal light and power plant and distribution system failed to obtain the required two-thirds constitutional majority. The vote was 844 for and 473 against. The proposal may be resubmitted at an early date.

CUSHING, OKLA.—Application has been made to the state advisory committee of the federal Public Works Administration for a loan of $300,000 to finance the construction of a municipal electric power plant and distribution system.

HOMINY, OKLA.—Application has been made to the state advisory committee of the federal Public Works Administration for a loan of $150,000 for the construction of an electric light and power plant and distribution system.

SAN FRANCISCO, CALIF.—Rescinding its former motion to submit two propositions to the voters on the Red Mountain Bar power project, one of which was for a power plant, to cost $1,000,000, and the other for a power plant combined with a transmission line and distribution system to cost $6,308,000 (ELECTRICAL WORLD, September 16, page 363), the Board of Supervisors has voted 11 to 2 to submit only the combined proposal to voters. It was freely stated the new plan to restrict the voters to the single proposition, thereby denying them a chance to express their wishes, would defeat the proposition.

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Boston Expands Steam Sales

Upon the completion of approximately two miles of underground steam line, now being installed, the Edison Electric Illuminating Company of Boston will have nearly seven miles of underground steam mains supplying space and water heating service to various large industrial and commercial buildings in the downtown section of Boston.

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New York Tax Program Approved

Following the approval of the New York tax program by the Board of Estimate (ELECTRICAL WORLD, Sept. 16, page 358), the Board of Aldermen passed the new levies which will become effective with the Mayor's signature after a final statutory public hearing. The new taxes of 1½ per cent on public utilities were amended in both branches of the municipal Assembly before passage so that the tax falls upon the gross revenues of such companies instead of upon their gross incomes. Latest additional proposals call for a tax on electric signs.

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Twenty-one Utilities Fight Illinois Tax

Throwing in their lot with that of the Commonwealth Edison Company, Peoples Gas Light & Coke Company and the Public Service Company of Northern Illinois (ELECTRICAL WORLD, August 26, page 262), eighteen other Illinois utilities have filed suit in Cook County Court asking injunction to halt the collection of the 2 per cent tax on electricity, gas and water service by the state director of finance. That the tax should not apply to electricity, gas and water, inasmuch as they are not tangible commodities, was basis of the action. The injunction was granted this week.

The petition stated that "public utility corporations traditionally, historically and by law are charged with the duty of furnishing their respective utility services to the public, and such corporations, unlike the merchant, shopkeeper or other vendor, are, in furnishing such services, not engaged in the business of selling property of any kind at retail as the expression 'sale at retail' is popularly understood, generally accepted and used in said act."

No taxes have been as yet paid under the tax act which went into effect on July 1. Difficulties beset the Illinois tax program from the very beginning, the 3-cent retailers' occupational tax having been held invalid by the state Supreme Court a month after it was enacted (ELECTRICAL WORLD, July 15, page 70). The 2-cent tax followed after certain objections to the original act were met.

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Grand Coulee Funds Allotted

An allotment of $1,000,000 to permit immediate construction work on the Grand Coulee Dam project on the Columbia River has been announced by Federal Administrator of Public Works Harold L. Ickes. The money is for the construction of working quarters and facilities for engineers and other construction forces on the site and the erection of a bridge across the Columbia River. The $1,000,000 allotment is in conjunction with a previous tentative allotment of $63,000,000 to an authority of the State of Washington, contingent on completion of a satisfactory contract with the Administration for financing the Grand Coulee Dam project. Legal difficulties, which may require legislative action in Washington, have delayed consummation of that contract.

New Radio City Elevators Travel 1,400 Ft. a Minute

Elevators in the main building of the Rockefeller Center, New York City, have been approved for operation at 1,400 ft. a minute, nearly 16 m.p.h. Of 75 elevators installed there, 24 operate at 1,200 ft. per minute. These are said to be among the fastest passenger elevators in the world. During performance tests some of the cars were run at 1,500 ft. per minute.

These elevators are of the automatic-landing type, with a travel from 497 to 770 ft. The highest rise cars (70 stories) make a round trip with terminal stops only in 95 seconds. They will be in motion about 58 per cent of the time and for 40 per cent of the time will be running at full speed.

Extremely close speed regulation has been devised by Westinghouse engineers for accurate stops. The 100 hp. motor equipment for handling these elevators, because of the long runs, is applied on a continuous rating basis. Power is supplied to them through individual a.c.-d.c. motor-generator sets in order to govern their operation by means of generator voltage control. This is a means of obtaining a variable voltage condition and gaining smooth acceleration.

▼

D.C. Breakdown Service Ordered

Under orders from the state Public Service Commission the New York Edison Company must furnish direct-current "breakdown" service to any present user of direct current who is willing to observe "reasonable rules and regulations." The commission rejected the company's plea that its comprehensive plan for replacing all direct-current supply with alternating current within the next 25 years would be impeded if direct-current consumers had to be supplied with that type of service upon application. The company declared its willingness to provide an alternating-current "breakdown" service upon request.

▼

Austrian High-Pressure Station

Completion of the first 42,000-kw. section of the Trebovice steam station in the Ostran-Karwin coal field of Austria brings a new high-pressure plant into operation. Here three Loeffler boilers, each capable of providing 63 tons of steam an hour at a pressure of 1,985 lb. per square inch and at a temperature of 932 deg. F., are installed. Two three-stage condensing turbines, direct coupled to 6,300-volt alternators, are used. Transmission from the station is at 110 kv.

Photo-Cell Control Executes Predetermined Hydro Operation

By JOHN FIES

Dallas, Tex.

Devised originally for the Llano River hydro plant of the Texas Power & Light Company, this control mechanism is applicable to any mechanism for which a schedule of operation can be predrawn as a graphic chart.

The hydro station operates:

—Unattended and fully automatic.

—As a generator or synchronous condenser.

—With generator output controlled by paper chart.

—With condenser output controlled by system voltage.

—With high efficiency from one-quarter to full load.

—With generator output modified by rate of stream flow.

Equipment at the hydro plant consists of a Smith-Kaplan type vertical turbine direct connected to a 625-kva., 2,400-volt Westinghouse generator provided to operate as a synchronous condenser as needed.

H. E. McDowell has applied for a patent on this device, which was perfected, built and applied by the author.

SCHEDULES of operation can be predetermined for small hydro plants and drawn in the form of a graphic chart which a photo-electric control mechanism will follow, actuating the devices which manipulate the gates to obtain the desired output. Such a device has been controlling the periods of operation and the output of the unattended Llano River station of the Texas Power & Light Company.

The photo-electric device (Figs. 2 to 5) consists fundamentally of a source of light, a paper chart, a drive for the paper chart, a photo-electric tube or photo-cell, an electronic amplifier tube, a means of biasing the amplifier tube grid potential, two sensitive relays in series, an electronic tube voltage regulator, two auxiliary relays, carriages for supporting the photo-cell and light source, a motor for driving these carriages in such a manner that the center lines of the light source and photo-cell are common and in moving trace a line which is at right angles with the motion of the paper chart and a precision potentiometer geared to the carriages.

The operation in general is as follows (refer to schematic wiring diagram, Fig. 1): A high-intensity lamp projects a beam of light through a $\frac{1}{16}$-in. diameter quartz rod, through the paper chart into the photo-cell. The paper chart is a strip chart similar to those used in graphic wattmeters. It is of standard width and a week long, assuming a longitudinal progression speed of 2 in. per hour. It has a line of opaque black ink drawn on it tracing out the desired variations in generator load. The chart, theoretically, should be opaqued between the traced line and the bottom or zero load reference point, making the lower portion of the chart opaque, while the portion above the traced line is left translucent (in Fig. 6a the traced line represents the top edge of the black line curve). Actually it is necessary only to add enough opaque ink below the traced line to make the opaqued portions at all places of greater width than the diameter of the quartz rod.

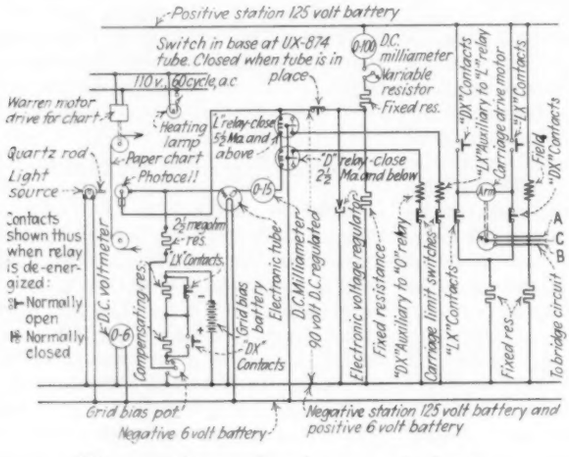


Fig. 1—Photo-electric control circuit

Relays *L* and *D* are the heart of the device and keep the beam of light on the chart line.

The cathode of the photo-cell is connected to the grid of the amplifier tube, which is biased by means of a negative grid-bias battery. Since the plate current of the amplifier tube varies with the amount of negative bias on the grid it must vary with any variation in the conductivity of the photo-cell and hence with any variation in the intensity of light on the photo-cell. With maximum light passing through the paper chart into the photo-cell there is a plate current of approximately 9 milliamperes; with no light on the photo-cell there is a plate current of approximately ½ milliampere. Therefore when the light source and photo-cell traverse the chart there is a plate current of 9 milliamperes on the translucent side of the traced line and ½ milliampere on the opaqued side; also, there is a position over the line tracing between the opaque and translucent sides where the current is approximately 4 milliamperes. The plate current passes through two sensitive relays in series. One of the relays is calibrated to close at and above 5½ milliamperes. The other relay is calibrated to close at and below 2½ milliamperes. Thus, it is evident that when the light is on the translucent portion of the chart

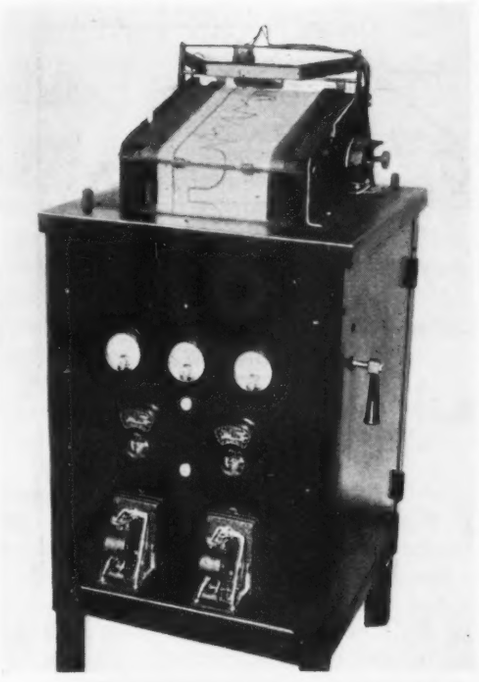


Fig. 2—Station operation dictated by chart

Covers removed from relays and chart member. Turbine gate openings actuated by light beam and photo-cells in accordance with predetermined loading schedule. Later model has precision potentiometer (see Fig. 7) supplanting radio rheostat at right side top. Amber glass viewing window in top cover keeps stray light under control.

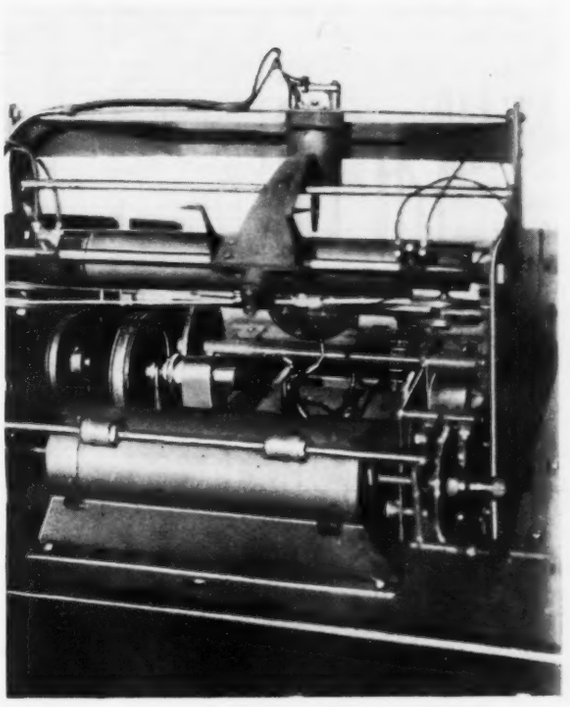
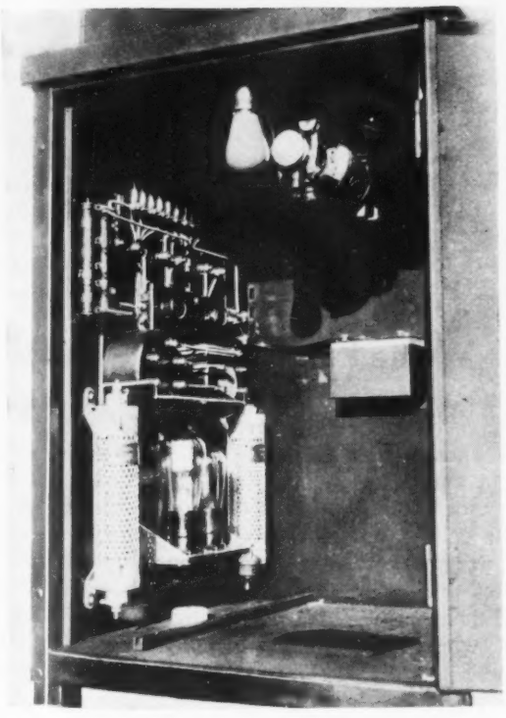


Fig. 3—Turbine operation follows chart line

Lamp carriage moves automatically if its beam, directed at photocell, gets off the predrawn black load line on the chart traveling at 2 in. per hour.



Voltage regulator, amplifier tubes, C battery, carriage drive motor, rheostats and heater lamp to avoid condensation. Baffles keep accumulating chart paper from back-of-panel equipment.

Fig. 4—Auxiliary regulating devices housed in base of cabinet

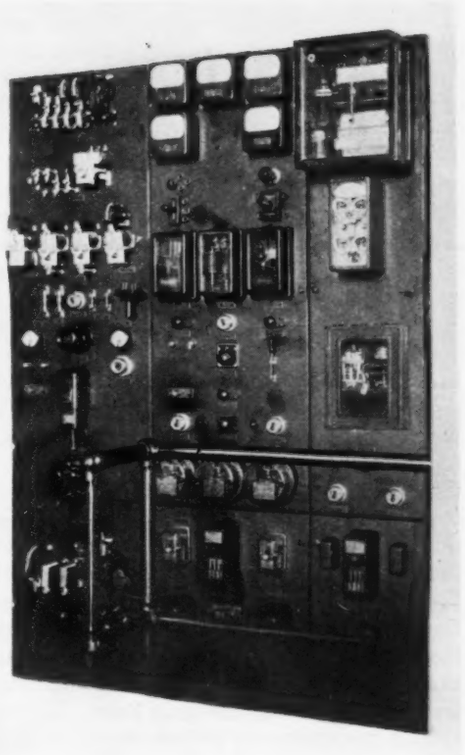


Fig. 5—Alternator operated automatically as generator or synchronous condenser

Automatic panel makes machine start or stop responsively to load in accordance with dictates of photo-electric device of Figs. 2 to 4. On right panel graphic wattmeter has screw-driven pen carriage geared to precision potentiometer. Below, the output watt-hour meter and galvanometer - operated proportional step controller (motor - driven cam type) which originates the impulses to the waterwheel governor. At the bottom, relays which originate the starting and stopping impulses.

the 5½-milliampere relay is closed, that when the light is on the opaque portion the 2½-milliampere relay is closed and that there is a position half way between the translucent and opaque positions where both relays are open.

Auxiliary relays are used in the device because the sensitive relays have very little contact capacity. The auxiliary relays operate to energize the carriage drive motor, which is reversible, to drive the carriage toward the translucent or opaque sides of the tracing as prearranged to always bring the center of the projected light toward the intersection of the two portions; that is, over the traced line when both sensitive relays are open. Thus the light beam follows the edge of the curve as the chart passes under it. The line may be smooth or irregular, but the light source will always maintain a position centered on the edge of the tracing. If for any reason the light should cross the opaque line it will travel to the zero limit and will no longer be controlled by the curve until picked up again at some zero point

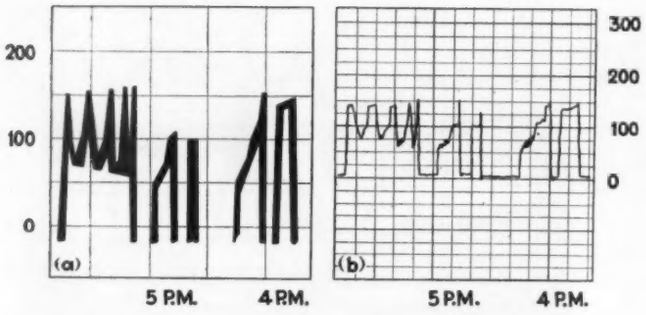


Fig. 6—Load curve duplicates predrawn chart

Zero point of wattmeter chart displaced to permit recording of power input when machine operates as synchronous condenser. Both charts are of same width and progress at the rate of 2 in. per hour.

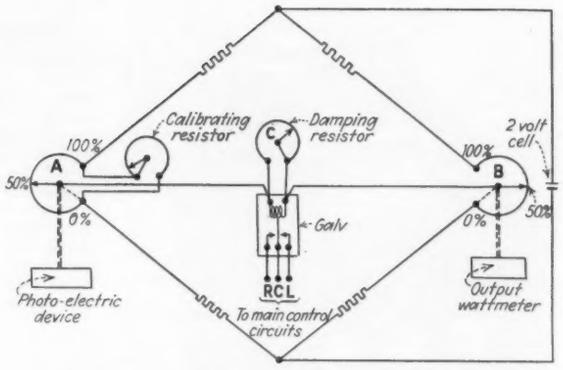


Fig. 7—Control bridge comprises two potentiometers

of the curve. The zero and maximum points are established by limit switches attached to the carriages.

The varying density of the paper chart, the light blue co-ordinate lines and the minute irregularities of the edge of the opaque curve cause the sensitive relays to be "nervous" when the paper chart is moving, due to the extreme sensitivity of the photo-cell. When a relay is nearly closed its contacts would chatter without some form of compensation. Compensation is accomplished by placing resistors in series with the grid biasing potentiometer (Fig. 1) and cutting in and out these resistors by means of extra contacts on the auxiliary relays to raise or lower the grid bias potential and cause the plate current to increase or decrease a slight amount and thus require a greater variation of light on the photo-cell to open than is required to close the contacts of the sensitive relays.

The photo-cell anode and the amplifier plate circuits are maintained at a positive 90-volt d.c. potential obtained from the station battery and regulated by a standard type of electronic tube voltage regulator. The carriage drive motor is arranged for quick reversing and dynamic braking.

A bridge circuit (Fig. 7) was provided which consists primarily of four elements as follows: A 2-volt dry cell source of potential, potentiometer *A* of the photo-electric device, potentiometer *B* of the output wattmeter and the galvanometer device, complete with contacts *R* and *L*. These elements, together with the intervening resistors, calibrating resistor and the damping resistor *C*, form a circuit similar to the Wheatstone bridge. The precision potentiometer *A* is geared to the carriage of the photo-electric device in such a manner that the angular variation of the potentiometer are proportional to the variations of the instantaneous ordinates under the curve on the strip chart.

The resistance of potentiometer *A* is balanced in the bridge circuit against the resistance of a similar precision potentiometer *B* located near and geared to the movable pen carriage of a graphic wattmeter. The latter potentiometer varies in proportion to the power output of the generator, and thus unbalance exists in the bridge circuit when the instantaneous ordinate of the graphic wattmeter is not equal to the instantaneous ordinate of the master chart. For example, if the photo-electric device changes position in following the curve, the sliding contact of potentiometer *A* moves and unbalances the bridge and the sliding contact of wattmeter potentiometer *B* must then move an equal amount in the same direction in order to bring the bridge again in balance.

Unbalance in the bridge circuit is translated by the galvanometer device (*G* in Fig. 7) into periodic impulses to a motor on the gate limit mechanism of the waterwheel governor and causes the waterwheel gates to open or close to bring the power output to the value indicated by the chart and balance the bridge circuit. This bridge circuit, by modifications not shown in the figures, also originates indications, which by means of the automatic control panels start and stop the generator. To provide for irregular stream flow at the hydro plant float switches have been provided to cause the generator to operate at full load when the reservoir is full and water is likely to be wasted and to prevent the operation of the generator when the water level is too low for satisfactory operation. These are independent and supersede the indications of the photo-electric device.

Customer Wants Lighting, Not Engineering

As short a time ago as five years practically all I ever heard, with some important exceptions, in connection with the selling of light was a conglomeration of words that largely revolved around lumens, foot-candles, kilowatt-hours and other similar terms with which the engineer and many utility employees delighted to conjure, and without which, and their knowledge of them, we would indeed be in a sorry state. The customer, however, wants good lighting or better lighting, or more profits or greater floor traffic, or impelling advertising or eyesight conservation, or the ability to play or watch at night games of his own choosing. Rarely does he care or know about lumens or watts or foot-candles.

With lean years and the falling off in sales of lighting and lighting equipment, the keener salesman, who has long known that most customers buy only results, has come into the lighting field and, increasingly during recent months, we have seen him selling the customer lighting results. Less and less of the customer's attention has been directed to the marvelous intricacies of equipment and methods.

GEORGE E. WHITWELL,
Chairman Sales Committee, Edison Electric Institute.

Industrial Up-Rush Halted in August

After four months of unprecedented gains August returns on electrical energy consumption indicate that the general average of industrial activity failed to register a further rise. On the basis of total energy consumption in the various industries reporting, it is true that the index for August shows a rise of 1 per cent over July. In that sense it might be said that the upward movement was still in progress.

But July contained five Sundays and a national holiday. August had four Sundays. When adjustments are made, as in the accompanying table, to take account of that difference in the number of working days, August shows a decline of 7 per cent from July in the rate of activity. There remains, however, a gain of 44 per cent over the corresponding month in 1932, which is nearly the same as the gain in July.

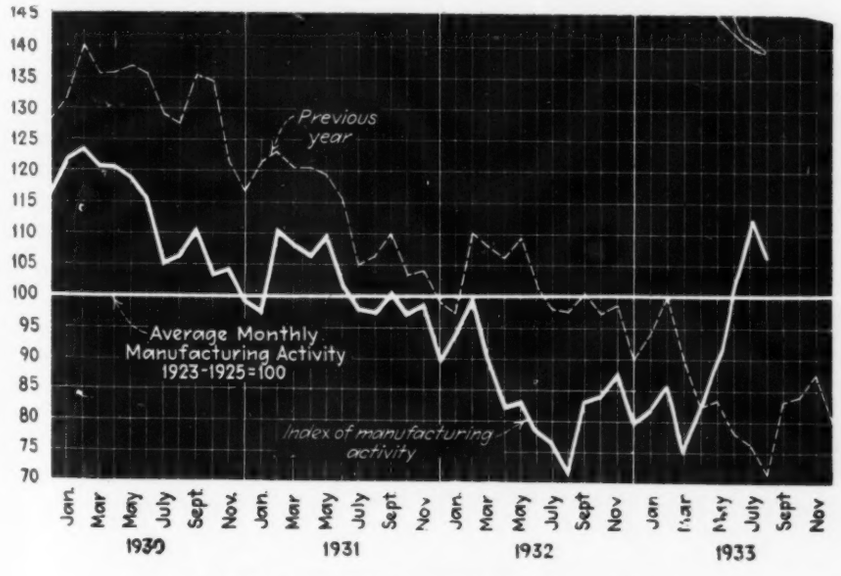
Revisions to include late returns have been incorporated in the index numbers for June and July. The effect has been to increase the figures, especially for the latter month, for most of the industries as well as the national and all regional averages above those previously announced.

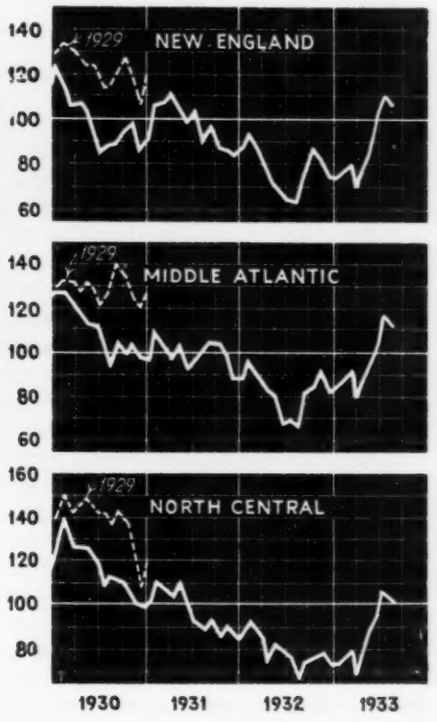
Comparison of the revised figures with those for August reveals no radical recessions, and even in some instances a moderate advance. Paper and pulp in New England and the North Central region, rubber and forest products in New England, leather in the Middle Atlantic, all gained moderately.

In contrast, a number of large textile mills in New England used less energy than in July, indicating a material slowing down in view of the difference in number of working days. In the Middle Atlantic and Midwestern region, though not in the South, this industry sagged less.

The metals group throughout the country operated at double the rate reported a year ago, and automobile factories did nearly as well. Rubber products have advanced proportionately.

From the low point to which manufacturing activity had fallen a year ago the upward progress has attained approximately the average level of the latter part of 1930 and early 1931.





Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

	United States				New England				Middle Atlantic				North Central			
Industrial Groups	Aug., 1933	July, 1933	June, 1933	Aug., 1932	Aug., 1933	July, 1933	June, 1933	Aug., 1932	Aug., 1933	July, 1933	June, 1933	Aug., 1932	Aug., 1933	July, 1933	June, 1933	Aug. 1932
All Industry	**105.2**	**112.4***	**104.5***	**73.5**	**106.3**	**110.1***	**104.7***	**67.7**	**112.6**	**119.0***	**108.8***	**68.4**	**100.5**	**107.8***	**97.8***	**66.8**
Automobiles (including parts and accessories)	62.6	66.6*	65.5*	33.7	....	....	....	....	62.7	68.7	64.0	36.6	62.3	66.1*	65.8*	33.6
Chemical products (including oil refining)	143.5	146.7	135.7	116.6	152.0	160.7	163.0	121.8	151.2	162.6*	143.0	123.5	142.5	145.5*	129.4	99.0
Food products	136.3	149.8*	136.0	123.2	....	....	....	....	145.8	156.0*	147.4	95.8	132.0	149.1*	131.4	127.0
Iron and steel	88.7	95.0*	79.8	44.0	152.2	159.7	135.7	79.8	73.2	79.2*	65.5	33.1	94.5	102.8*	86.8	47.7
Metal working	75.3	79.6*	72.6	45.0	105.3	107.1*	99.5*	54.4	65.0	65.6*	63.0	47.0	78.4	84.5	77.5	39.8
Metal group	80.3	85.3*	75.3	44.7	118.3	121.8*	109.6*	61.7	68.5	71.4*	64.1	41.0	84.5	91.5*	81.0	42.8
Leather products	100.6	102.7*	100.2	82.2	89.2	96.0	90.8	85.7	123.2	116.5	124.8	91.0	85.0	89.7	84.4	65.5
Forest products	98.3	102.0*	98.3*	69.8	60.9	53.6*	48.6	37.1	67.5	72.0*	61.7	52.2	97.1	103.3	93.2	73.7
Paper and pulp	127.4	130.2*	126.5*	94.7	134.0	128.5	117.3*	98.3	99.7	106.8*	99.5	62.5	123.0	121.0*	123.0*	92.7
Rubber products	143.5	157.0	146.4*	76.4	144.9	136.8	138.2	72.5	....	....	....	....	140.0	159.7	146.0	74.8
Shipbuilding	80.0	75.7*	75.7	77.9	....	....	....	....	....	....	....	....	....	....	....	....
Stone, clay and glass	104.1	113.5*	102.0	71.8	....	....	....	....	92.0	100.7*	87.6	53.6	123.2	131.5*	112.4*	84.0
Textiles	109.4	121.3*	118.2*	65.7	82.8	90.5*	90.8	53.8	153.3	160.6*	146.0*	73.5	122.0	122.3*	119.5	84.5

*Revision.

Residential Load Possibilities

By E. S. FITZ
General Manager, Electric Department, Virginia Electric & Power Company

MUCH is heard in electric utility circles about the tremendous load and revenue possibilities of the residential field. We hear that the national average consumption is some 600 kw.-hr. per year and that we can hope to see it grow in a few years to 1,000 kw.-hr. This seems a phenomenal possibility, yet it is a mere nothing to the real possibilities.

We should consider 1,000 kw.-hr. per month average electricity use by a residential customer as a possibility of the not-distant future.

The use of electricity in residential heating and air conditioning offers the greatest possibility of quickly building up the residential load. The uses of heating with which we are most familiar are for cooking. This use has become fairly well accepted, both on the score of convenience and economy. The use of electricity for water heating is gradually making headway. This use, however, is handicapped by a lack of the proper layout of equipment in the home and also due to the fact that plumbing manufacturers have not yet placed equipment upon the market fully adapted to the use of electric water heating. We are still waiting for the kitchen sink with the built-in water heater, and where is the combined lavatory and bath with the built-in water heater? Where are the electric water heaters that take advantage of the sun's radiant heat and simply add sufficient heat to make up the necessary requirements? We need efficient electric water-heating installations which may be obtained by avoiding pipe radiation losses and by using electricity to supplement other heat supplies. Small hot water requirements will be handled with direct electric heating at the point of use and bulk hot water requirements by using electricity to control and supplement some method of heat pumping largely dependent upon atmospheric heat.

Space heating in the residence will be accomplished electrically in a similar manner to that applying to the water-heating problem. This heating will be combined with the work of air conditioning giving the proper air movement and conditions of humidity and temperature.

In the solution of these heat supply problems we shall have to pass through the crude stages, where the electricity is used inefficiently, to the stage where electricity will be largely the controlling agent rather than the prime supply of heat.

At the present stage of growth of the residential electrical load the greatest handicap to the electrical industry is the inadequacy of residential electric wiring.

This situation is vital to all branches of the electrical industry and deserves immediate attention.

Residential wiring has not kept pace, particularly as regards capacity, with the improvement in utilization devices. Interior wires and convenience outlets of adequate size are not available in any but a small percentage of residences. Many of the present popular appliances require electric currents exceeding the capacity of the common standard convenience outlets and the wires supplying them. Among these appliances the following are mentioned: Automatic flatirons, ironing machines, hot plates, portable ovens, space heaters, small water heaters, sunlamps, etc.

Heavy-duty 20-amp. convenience outlets are available from the wiring manufacturers, together with the wiring supplies to fit them. Why are we so slow in adequately wiring our residences? Why do we think of No. 14 B. & S. wire as the usual size wire to use? Why not think of No. 10 wire as a normal size? Why not wire our residences for electrical performance requiring normal voltage delivery to the appliances we wish to operate? Why not set up a standard of at least two 20-amp. convenience outlets in the kitchen, laundry, bathroom and living room? Why not have three-wire outlets where desirable? In large installations three-phase, four-wire would seem to be desirable.

Residential wiring still is primarily lighting wiring, whereas it must be considered as power wiring if satisfaction is to be obtained by the customer. More publicity and action are needed in the electrical industry on the matter of residential wiring.

Electrical wiring contractors, wiring manufacturers and jobbers have a fertile field before them. Electric public utilities have a tremendous job ahead of them, in co-operation with the contractor-dealers, in educating the residential consumers to the needs for higher capacity wiring. The utilities must get behind this work if their residential load is to grow satisfactorily, as the constant trend to lower rates and improved lamp efficiences make it necessary to obtain other than lighting loads in residences to even maintain these residential electric revenues.

With increment revenues from residences of 2 cents per kilowatt-hour and lower it is easy to see that electric energy must be sold in large quantities by the utilities to residences in order that any considerable dollar increase may be realized from these residential sales.

Many utilities have made considerable progress in the installation of heavy-duty residential entrances, although this work is only in its early stages.

Inadequate residential interior wiring, however, is the present major handicap to sales of household appliances of greater capacity than 700 watts. It is a challenge which must be met by the whole electrical industry.

The immediate recommendation of No. 10 B. & S. wire as a minimum size for residence convenience outlet wiring should be an initial step by the utilities toward improving the present situation. Satisfactory service to the consumer and increased revenue to the utility are both at stake.

Why don't we get busier on this whole problem?

South and West Pause in Ascent

In the South and West industrial activity, as measured by energy consumption in individual manufacturing plants, receded somewhat in August, approximately in the same ratio as in other parts of the country. In the South the decrease in the general average was about 9 per cent, compared with revised figures for July. In the West the recession was smaller, being around 6 per cent. The gains over August, 1932, were 31 and 25 per cent, respectively. The rise has been sufficient to restore the levels of the early part of 1931, which is as far up as the rest of the country has gotten.

Moreover, a portion of the apparent recession may be ascribed to the adjustment for number of working days in the different months. Without such adjustment total operations in the South were virtually equal in July and August, while in the West the figure for the latter month is 1 per cent higher than that for July.

Southern chemical plants almost maintained the July rate of activity, 26 per cent better than a year ago. The iron and steel industry continued its upward trend, overshooting July by 2 per cent and again nearly doubling last year's August figure. Textile mills slackened, against an acceleration last year, but a gain remains of 50 per cent.

In the West, metals, shipbuilding and the stone, clay and glass group made the best showing, either advancing or, at worst, falling but slightly. In all lines except food products present levels are far above last year's in both sections.

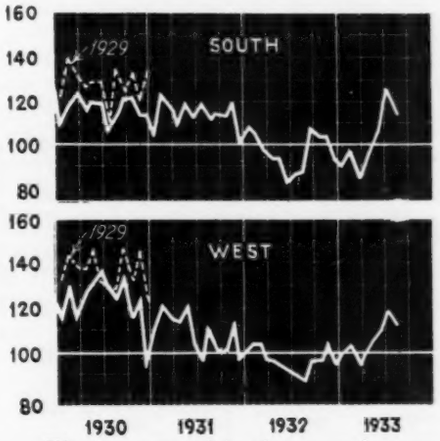
Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

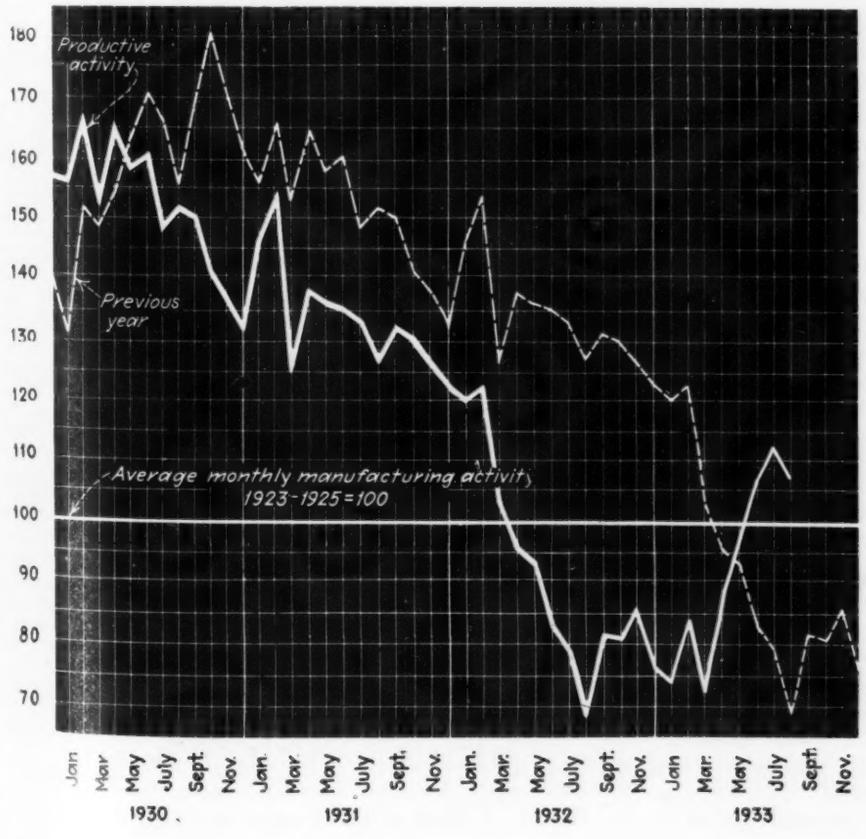
(Corrected for number of working days, but not for seasonal variation)

	South					West				
Industrial Groups	Aug., 1933	July, 1933	June, 1933	May, 1933	Aug., 1932	Aug., 1933	July, 1933	June, 1933	May, 1933	Aug., 1932
All Industry	**114.8**	**125.7***	**121.3***	**103.9**	**87.9**	**111.0**	**118.3***	**111.6**	**107.0**	**89.4**
Chemicals	152.2	155.0	147.4*	139.0	120.8	80.0	87.5	74.7	77.5	85.3
Food products	156.5	170.7	163.4*	149.8	153.7	115.8	132.2	126.0	125.3	113.6
Iron and steel	147.8	145.0*	127.1*	93.8	79.0	....	....	....	....	....
Metal working	93.2	99.7*	88.5*	71.6	62.8	....	....	....	....	....
Metals group	123.6	124.8*	110.0*	84.1	72.0	71.4	70.3*	62.2	57.7	35.6
Forest products	51.6	54.4	49.6	43.3	33.7	151.5	156.0*	154.0	144.2	104.8
Paper and pulp	164.5	173.6*	167.5*	148.0	114.1	134.0	150.3*	159.7	139.2	126.7
Rubber products	137.4	148.4	146.3	129.1	88.9	108.7	125.3	106.0	73.2	92.8
Shipbuilding	....	....	....	....	....	117.2	113.6	107.2	98.1	96.5
Stone, clay and glass	99.1	121.0*	137.0*	113.0	103.2	116.0	118.0*	107.8	104.2	82.0
Textiles	123.0	146.0	146.3	116.1	81.2	....	....	....	....	....

*Revision.



Electrical Production Slackens



Plants engaged in the manufacture of electrical goods operated at a slightly slower rate in August than in July, it is indicated by the reports of energy consumption in such establishments received by the ELECTRICAL WORLD. Although slightly more energy was used than in July the rate after adjustments for the number of working days was down 6 per cent.

Compared with August of last year, the lowest month on record, the rise is close to 60 per cent. Progress during the past 3 months has been made chiefly in the group of large companies, which advanced 25 per cent, while the average for the numerous smaller ones has varied but little since May.

Monthly Index of Electrical Manufacturing Activity

Adjusted to 26 working days

Base: Average Month, 1923-1925

Month	1930	1931	1932	1933
January	156.2	146.6	120.0	74.0
February	165.2	154.3	122.2	83.3
March	153.0	126.1	102.9	75.0
April	164.9	138.1	95.6	89.4
May	158.0	136.7	92.8	104.1
June	160.2	135.2	83.1	106.9
July	148.5	133.4	79.2	114.0
August	152.2	126.9	67.6	107.2
September	150.0	132.6	81.4	....
October	140.6	130.4	80.9	....
November	137.5	126.9	85.6	....
December	132.4	123.5	76.0	....

Save Money on Secondary Distribution

By D. K. BLAKE

Engineer Distribution Systems,
General Electric Company, Schenectady, N. Y.

Start with analysis of load and consider possible load changes.
Domestic load growth will require maximum future expenditures.
Good engineering required on sizes, layouts and systems.

IT IS generally conceded that distribution system economics deserve relatively greater attention from an economic point of view. For a good many years the distribution expenditures were overshadowed by those of generation and transmission. However, by 1929 the distribution expenditures assumed a leadership that stubbornly resisted the efforts at reduction during 1932, when they were almost four times that of either generation or transmission. The total system investments for two large operating companies are given in an accompanying chart. The first company has an extensive transmission system supplying a large number of small cities and towns. The second system supplies a large metropolitan city and its immediate surroundings. The figures show plainly enough that distribution system investments are too significant to permit their continued increase without the most thorough economic analysis based on sound engineering principles and actual field data interpreted in the light of past experience. There is at present substantially more overbuild in generation and transmission than in distribution, so that in the near future the distribution system will occupy a more prominent investment position than it does now. The distribution expenditures are sufficiently significant to warrant employment of the best engineering talent available to reduce their value to a minimum and to assure that these expenditures are all made for facilities and improvements that will provide the best results. The rising cost per kva. of load distributed and per kilowatt-hour sold is in decided contrast to the lowering of rates.

Start with the loads

A consideration of the direction of procedure is important in studying economics of electrical distribution. It has been the habit of most engineers to consider the problem starting with the generating station and proceeding to the consumer, although it would seem that the best system layout would be obtained by starting with the consumer and working back to the generating station. An accompanying chart shows the successive steps in this method of study and the similarity of economic problems encountered in each step. The rectangular areas represent the same territory and show successive load areas to be used as units in the design of each step and the first rectangle shows as the starting point the locations of the consumers and the generating station as the terminus, both of which are rigidly fixed as far as the distribution engineer is concerned. The voltages of the consumer's utilization devices are also fixed, so the first problem becomes largely one of deciding on how many customers are to be connected to each distribution transformer. The proper economic solution of this problem determines the kva. of the transformers, distance between the transformers and size of secondary wire, thus establishing the secondary system design, which is the subject of this discussion.

The next rectangle shows distribution transformers and it will be observed that the dots are larger and spaced farther apart. The planning engineer now deals with distribution transformers as units instead of consumers, but his problem of determining how many distribution transformers are to be combined upon each feeder is precisely the same as before. The economic solution of this problem, however, is not simple, as it

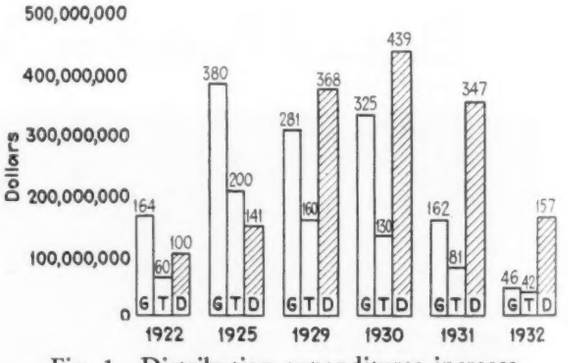
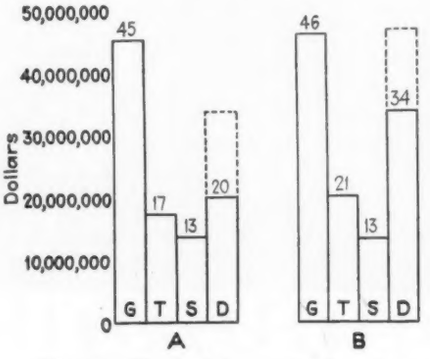


Fig. 1—Distribution expenditures increase

The importance of distribution system investments is shown by considering the yearly expenditures of the industry published annually in the Statistical Number of the ELECTRICAL WORLD. A few of these years have been selected and tabulated in the illustration. The distribution expenditures have rapidly increased until it has become the outstanding item.



The distribution system represents a substantial part of the total system investment. The dotted line over distribution shows the superposition of the substation investments, most of which are for distribution purposes and are properly charged as a part of the distribution system itself.

Fig. 2—Typical investments of two utility systems

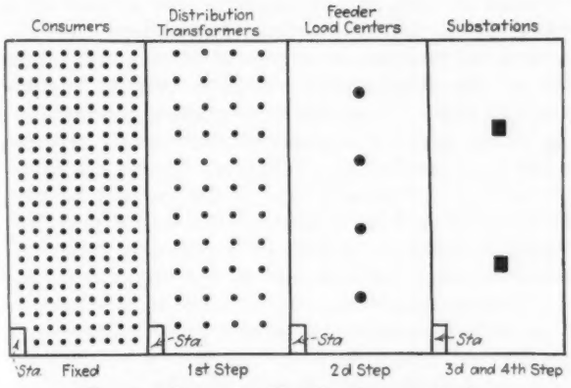


Fig. 3—Steps in distribution analysis

Procedure in an economic analysis starting from the consumer and working back to the generators. Each rectangle represents the same area, but shows different major economic elements of the system. The first step uses consumers as units to determine the number for each transformer and thus settle the secondary system design. The other steps use distribution transformers, feeder load centers and substations successively as units to determine the primary distribution system and the transmission system design.

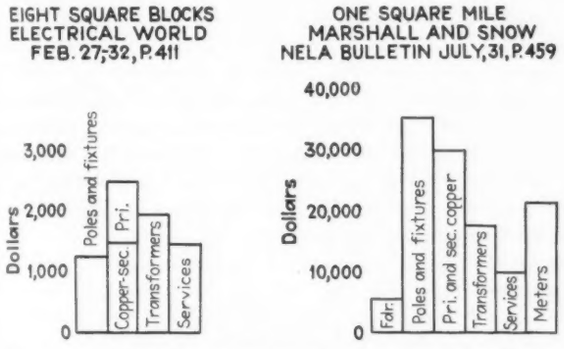
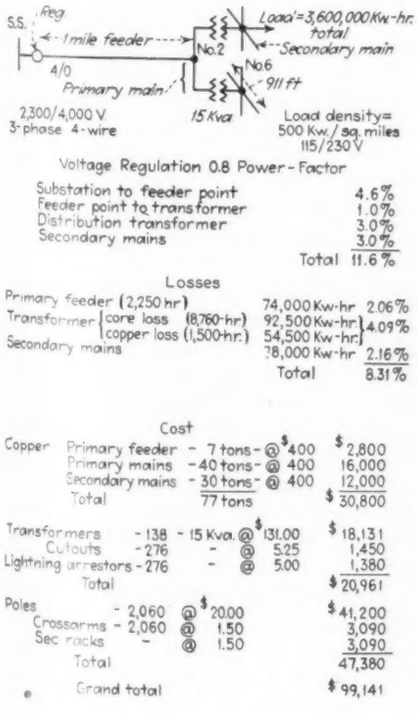


Fig. 5—Typical examples of prominence of secondary system cost for small territories within a larger system


S.S.
Reg.
1 mile feeder
No.2
Load=3,600,000 Kw-hr. total
Secondary main
4/0
Primary main
No.6
911 ft
15 Kva
2,300/4,000 V
3-phase 4-wire
Load density=
500 Kw./sq. miles
115/230 V
Voltage Regulation 0.8 Power-Factor
Substation to feeder point 4.6%
Feeder point to transformer 1.0%
Distribution transformer 3.0%
Secondary mains 3.0%
Total 11.6%
Losses
Primary feeder (2,250 hr) 74,000 Kw-hr 2.06%
Transformer core loss (8,760 hr) 92,500 Kw-hr 4.09%
Transformer copper loss (1,500 hr.) 54,500 Kw-hr.
Secondary mains 78,000 Kw-hr 2.16%
Total 8.31%
Cost
Copper Primary feeder - 7 tons - @ $400 $ 2,800
Primary mains - 40 tons - @ 400 16,000
Secondary mains - 30 tons - @ 400 12,000
Total 77 tons $ 30,800
Transformers - 138 - 15 Kva. @ $131.00 $ 18,131
Cutouts - 276 - @ 5.25 1,450
Lightning arrestors - 276 - @ 5.00 1,380
Total $ 20,961
Poles - 2,060 @ $20.00 $ 41,200
Crossarms - 2,060 @ 1.50 3,090
Sec. racks - @ 1.50 3,090
Total 47,380
Grand total $ 99,141

Figs. 6 and 7—Economic design of distribution system

A division of a typical distribution circuit of proper design is shown in detail. About half of the voltage drop and two-thirds of the losses occur in the secondary system. In this example the secondary system costs are not so prominent as in the actual cases cited. This is due principally to the light load density and uniform conditions assumed, which, of course, do not exist in actual practice. Nevertheless, it is believed that this difference also indicates some possible savings by properly designed secondaries.

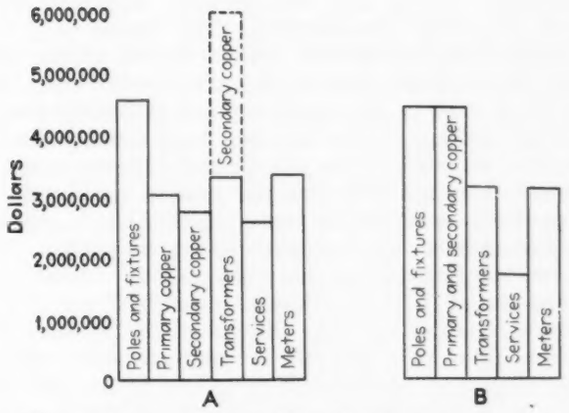
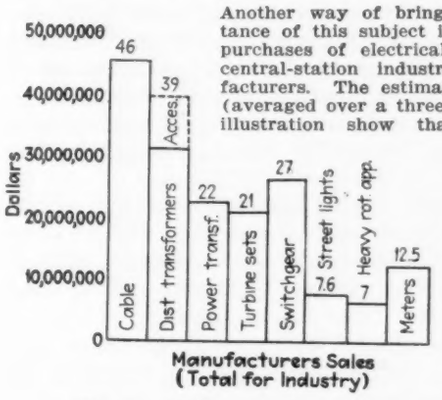


Fig. 4—Two typical utility distribution systems are broken down as to investments

The secondary system, consisting of the distribution transformers and secondary copper, is by far the larger item. For company B the secondary copper would be at least half of the total, and this superimposed on the transformers will be outstanding.



Another way of bringing out the importance of this subject is to show the total purchases of electrical equipment by the central-station industry from all manufacturers. The estimated annual amounts (averaged over a three-year period) in the illustration show that the distribution transformers are next to cable, which is the largest item. If the major portion of the expected increase in central-station output is to come from the domestic load the distribution transformers will constitute a still larger part of the total.

Fig. 8—Utility purchases from manufacturers

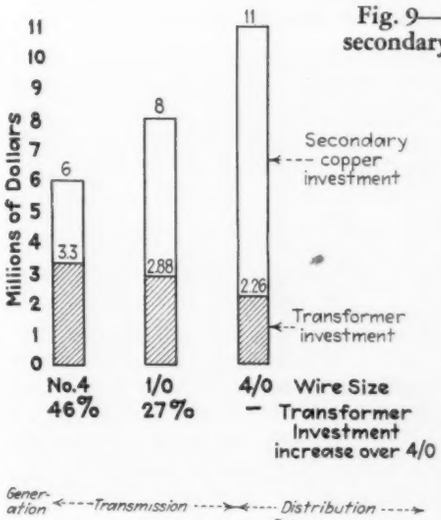
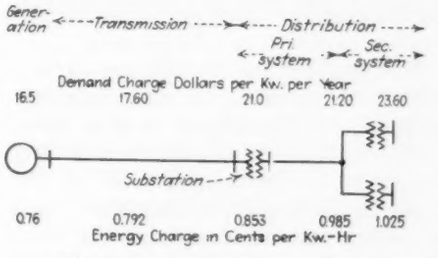


Fig. 9—Control of secondary investment

Illustrating how wide the range of investment might be in a secondary system for a given load. Note how the copper investment is greatly reduced by a smaller increase in the transformer installation investment.



The cost of losses in the system increases substantially until it reaches a maximum in the secondary system. These figures apply to an actual system, but were made several years ago and for that reason the energy charge is somewhat higher than at present. Nevertheless the relative amounts are about the same.

Fig. 10—Cost of losses increases in distribution

necessitates taking into consideration substation costs, which may vary considerably. The second step then establishes the feeder load centers shown in the third rectangle as larger dots spaced still farther apart, and the third step is to combine the distribution feeders with substations. After this has been accomplished in the most economical way the primary system design is settled. The last step uses the substations as units to determine how many are to be supplied from a generating station or other primary source of power. This fourth step establishes the metropolitan transmission system design. The method here outlined was chosen to bring out the fact that the design of the secondary system, although a problem in itself, requires substantially the same treatment in principle as the economic study of distribution feeders, substations and transmission circuits.

Economics should dictate

Problems of the distribution engineer are more economic than technical. The distribution system contrasts conspicuously with generating stations and transmission systems because of the large number of small kva. units which are scattered over a large area, making it difficult to obtain accurate and reliable data and to prevent waste. The distribution system also requires that its problems be analyzed on the basis of average conditions because it is very difficult to consider each particular locality in detail.

Intelligent approach to the economic problems of distribution requires numerous pertinent facts which can be obtained only with a liberal use of instruments such as demand and recording meters. Obtaining reliable data is the starting point. These data, however, will be of value only when interpreted with good judgment because the evaluation of average figures and the weight to be given certain factors have a very important bearing upon the result.

Application of diversity factors

One way of showing the importance of secondary system design is to apply diversity factors beginning at the generating station and proceeding to the consumer. For instance, 100,000 kva. of generating capacity will require approximately 110,000 kva. in substations, 127,000 kva. in distribution feeders and almost 200,000 kva. in distribution transformers. Thus it is seen that the kva. capacity of distribution transformers for domestic load is approximately twice the total kva. capacity of the generators necessary to supply the particular load. Obviously, therefore, the distribution transformer load factors. A large investment can be made in primary copper size of these distribution transformers is 15 kva., then the number of units exceeds 13,000, so that whatever becomes general practice for one transformer installation is multiplied 13,000 times. A few dollars saved per transformer installation on the average is multiplied many times and therefore amounts to a large sum.

Another way of bringing out the importance of secondary system design is to break down the investment into the various parts of the distribution system itself. For example, the distribution transformers and secondary copper represent by far the largest item. A distribution engineer can manipulate little other than these two items when balancing costs to determine the most economical design, although substantial savings may sometimes be effected by studying the details of such items as poles, fixtures, services and meters.

A detailed analysis of a typical distribution circuit is given in the illustrations showing voltage regulation, losses and costs. Any one may make a similar analysis using values that are considered more nearly representative for local conditions. Whatever figures are used, the importance of secondary system design will be demonstrated and it will be noted that the major parts of the investment, losses and voltage regulation occur in the distribution transformers and in the secondary conductors. A large investment can be made in primary copper and feeder regulators to secure good voltage regulation, yet the effect may be completely neutralized by poor secondary design. It will also be found that distribution transformers and secondary copper constitute a large item in the total on the basis of proper design and a very much larger item if the system is not properly designed.

Another way of bringing out the importance of this subject is to show how much money the central-station industry spent per year (averaged over a three-year period) in the purchase of equipment from manufacturers for use on its systems. This analysis shows that the central-station industry buys more cable (excluding bare or triple-braid weatherproof wire) than anything else from manufacturers. The expenditure for distribution transformers is an easy second and is approximately 50 per cent greater than the amount spent for turbines. The expenditures for accessories (fuse cutouts and lightning arresters) are as large as those for rotating apparatus and, combined with transformers, bring the total expenditure almost up to that for cable.

From the point of view of increase in domestic load practically none of the overhead secondary systems which supply domestic load have any appreciable amount of excess capacity.

Domestic load dominates

It is very instructive to study the industry statistics that are frequently published in the ELECTRICAL WORLD in the light of distribution system economics. There are about forty times as many domestic consumers as there are wholesale power consumers and about six times as many domestic consumers as retail power consumers and most of the latter are located in high load density areas of our larger cities. Therefore, most of the overhead distribution system is for the domestic load. If the distribution system were to supply only the wholesale and retail power consumers it would be quite limited in the territory covered.

The domestic load almost doubled from 1926 to 1931, including two years of depression. The figures are 6.8 to 11.7 billions of kw.-hr. for 1926 and 1931 respectively. The prominence of the appliance load in this increase is significant. Figures published in the ELECTRICAL WORLD some time ago show that the appliance load trebled in five years, increasing from 2,000,000,000 kw.-hr. in 1926 to 6,000,000,000 kw.-hr. in 1931. Three-quarters or three out of the four billion increase are attributed to three devices, the range, water heater and refrigerator. The significant thing about this is that, if such devices already available have such a pronounced effect upon the domestic load even during the depression, with their present low degree of saturation, it is certain that they alone will guarantee even greater increases on

the resumption of a reasonable amount of the public's buying power. It is therefore unnecessary to appeal to undeveloped usages of the future, such as air conditioning or house heating, to emphasize the future greater importance of the domestic load.

Future outlook

Now, if the relatively small volume of the domestic load of the past required such extensive distribution systems with outstanding expenditures, what will the situation be when the domestic load becomes five to ten times its present value. It is believed that a careful consideration will lead to the conclusion that the domestic load will account for the major system expenditures and that the distribution system will require most of this. Within the distribution system itself, the secondary system will require most of the money initially and ultimately. This is largely due to the considerable overbuild now existing in the other parts of the system, progressively increasing from the secondary system back to the generating station. Hence, secondary system economic studies are very timely as well as necessary.

Question use of large transformers and large wire

It is the opinion of some that, due to lack of careful investigation, the use of large kva. distribution transformers with correspondingly large secondary copper has been overdone. Studies recently made show that for a given load in a given area a design based on using No. 4 secondary wire had a very large cost advantage over designs based on using larger secondary wire as illustrated. Of course there are very few No. 4/0 secondary systems, but it is obvious that if such large wire is put up without careful consideration the increase of the investment over the more economical No. 4 secondary wire system would be almost 100 per cent. These figures take into account all factors and are comparable. This, of course, is only the initial investment, but a consideration of losses vs. carrying charges is also in favor of the smaller copper. It is, therefore, readily seen that a great deal of money can be wasted in secondary systems. These figures also indicate that much money has been wasted in the past by changing to a larger size wire, because of the expense of disconnection and reconnection of many services in addition to the cost of the wire. There are, of course, numerous special cases requiring larger conductors, but they are a small percentage of the total from the industry viewpoint.

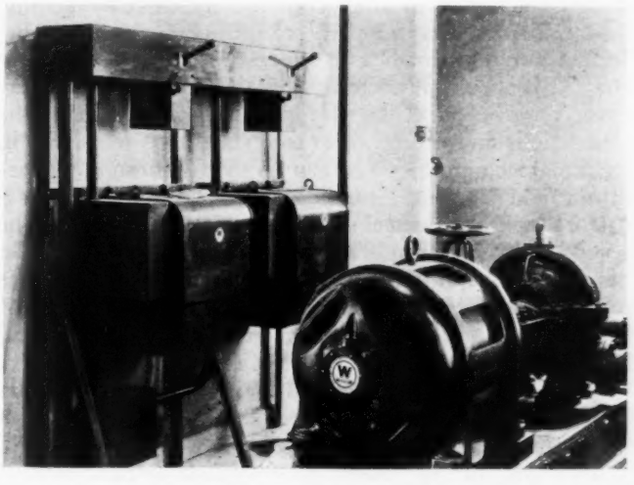
These problems have been studied by some engineers who have shown conclusively that substantial economies are to be made. It may be that some people feel that the problem is elementary and does not require engineering of the best type. Such a notion can easily be corrected by considering the factors involved in the secondary system design. Secondary system design requires a consideration of the permissible limits of voltage regulation as produced by the normal load and by the starting currents of motors. If the secondary system is designed for a normal drop of 2 per cent, that is one thing, and if 3 per cent is allowed, that is another thing, and the effect on the cost is very material. Motor-starting currents giving instantaneous drops in excess of 2 or 3 per cent are also factors to be dealt with.

The most important factor in the secondary system design is the load supplied. Most discussions of secondary system design have considered systems as being static. It is well to realize that the load on a distribution system is more of a transient nature, making it necessary for the distribution system to receive regular, careful and continued study. The initial load density is an important item and may be of the order of 10 to 20 kva. per 1,000 ft. and the rate of load growth may be 5, 10 or 15 per cent per year. The average demand for a consumer may be anywhere from 150 to 450 watts or even higher. Determination of the size, cost and spacing of distribution transformers involves a knowledge of their life and initial loading, which may be 80 to 100 per cent, with an ultimate loading of 125 to 150 per cent. The size, cost and losses of the secondary conductors are also to be determined. In this connection the life of the secondary wires must also be considered and may be fifteen up to twenty years. Other factors, such as equivalent hours for determining losses, demand charges and energy costs, are important and must be considered. It should also be recognized that conditions frequently occur causing the system to be dismantled in about one-half the expected time.

The foregoing brief reference to the factors involved in the study of secondary design should be sufficiently convincing that very careful and intense study is required properly to balance these factors to obtain the most economical design. The accumulation of a large amount of data and, what is more important, the exercise of the very best judgment are required in evaluating these factors. The present time is most appropriate for a study of this problem.

▼

Design Saves Circuit Breaker Space



Neat and economical is this design which mounts the oil circuit breakers ahead of the automatic compensators controlling two motor-driven pumps in the bus-gutter at which the supply feeder terminates. By this modification of the steel inclosure, easily accomplished with modern fabrication methods, the oil switches require no additional space and wiring costs are reduced materially. Operating convenience is another factor which makes this idea practical for practically any installation.

Adjustable-Ratio Transformer Aids Relay Testing

By J. W. LINGARY

Superintendent Electrical Plant,
Lynn (Mass.) Gas & Electric Company.

FIELD testing of relays had demonstrated the desirability of three characteristics in the relay-loading device: (1) Portability; (2) absence of wave-form distortion that will cause inaccuracies in timing, and (3) ability to supply all necessary test currents efficiently and economically from the conventional 120-volt branch-circuit outlet usually available wherever over-current relays are located.

However, the last requirement is not readily met by adjustable resistance-type loading devices because of the large amount of energy dissipated as heat compared with that needed to actuate the relay and the consequent demands on the branch-circuit wiring and fuse. For example, it is often necessary to test relays up to and exceeding 50 amp. to simulate probable short-circuit conditions in the field. With 50-amp. relay current, supplied from a 120-volt outlet, the total demand would be about 6,000 volt-amperes, of which approximately 5,675 watts would be consumed in I^2R loss in the box and only 225 watts would be required to actuate the relay and supply its losses.

Furthermore, since the supply circuit would usually have its neutral grounded, and since it is good practice to test relays with their current transformer connections intact (neutrals also grounded), it would be necessary to use an insulating transformer in the supply line. Such a transformer, due to the necessary capacity, would be bulky and cumbersome and cause some inconvenience in manipulation at the expense of additional time and labor.

Considering these and other factors in relay testing, this company has adopted an adjustable-ratio transformer for relay loading to supersede the resistance load box. It is shown in an accompanying illustration with its cover removed; the diagram gives a general idea of the connections and rating. The secondary taps terminate in a circular commutator (similar to that used on d.c. generators and motors), upon which a contact brush is rotated by a hand wheel on the exterior of the case. The secondary voltage can be adjusted from 0.5 to 50 volts in 88 steps of approximately 0.58 volt each. Care was exercised in the design of flux linkages and selection of core iron to avoid wave distortion from saturation and hysteresis. When testing relays the transformer primary should be constantly energized and switching done only in the secondary circuit to avoid wave distortion from the exciting current.

Mounted in its case, this adjustable-ratio transformer weighs less than 50 lb. and measures 14x11x11 in. over all. The case is equipped with shoulder-carrying straps.

Although it was anticipated that relay timing would be consistently slow when tested with an adjustable-ratio transformer, even if well designed, compared with a resistance load box, the degree of slowness that would result was believed to be of no consequence, as some manufacturers allow a tolerance of 5-7 per cent deviation from the time given on the relay index plate usually attached to overload relays. Acceptance tests proved this correct.

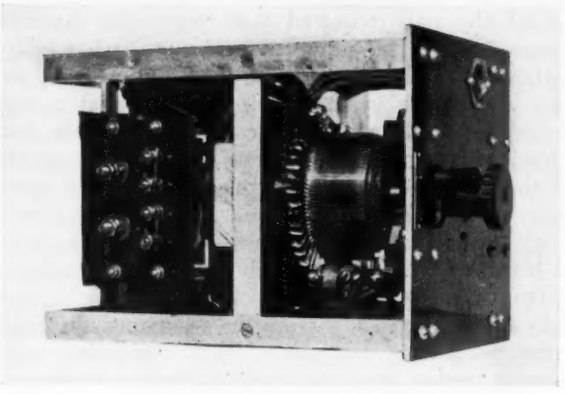


Fig. 1—Adjustable-ratio relay-loading transformer with cover removed

When used to test induction-type inverse-time relays (which constitute the majority of relays on the system) oscillograms of the relay current and wave form showed the presence of thirds, fifth and possibly higher harmonics due to saturation and hysteresis in the iron core of the relay. It was found that insertion of series resistance equivalent to about ten times the relay reactance would almost entirely suppress these harmonics, but this amount of resistance is not always practical. By using a resistance-relay-reactance ratio of 5:1 and comparing relay timing with that obtained with a resistance load box a maximum deviation of 3.2 per cent was obtained

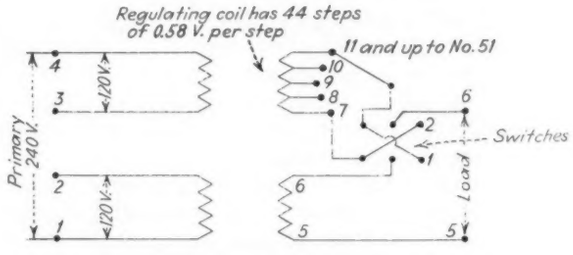


Fig. 2—Transformer connections give 0.5 to 50 volts in 88 steps

Maximum output—1½ kva.
For use only in 120 or 240-volt, 60-cycle circuits.
For 120-volt primary connect terminals 1 to 3 and 2 to 4.
For 240-volt primary connect terminals 2 to 3
For secondary voltage from 0.5 to 25.5 volts use position No. 2 of switch.
For secondary voltage from 25.5 to 50 volts use position No. 1 of switch.
To advance voltage from 0.5 to 25.5 volts turn knob in clockwise direction.
To advance voltage from 25.5 to 50 volts turn knob in counter clockwise.
Primary voltage to be connected to flexible cord.
Load to be connected to terminals 5 and 6.
Capacity—30 amp. continuous; 36 amp. 60 minutes; 45 amp. 20 minutes; 53 amp. ten minutes; 60 amp. five minutes; 68 amp. three minutes; 100-120 amp. for ten seconds.

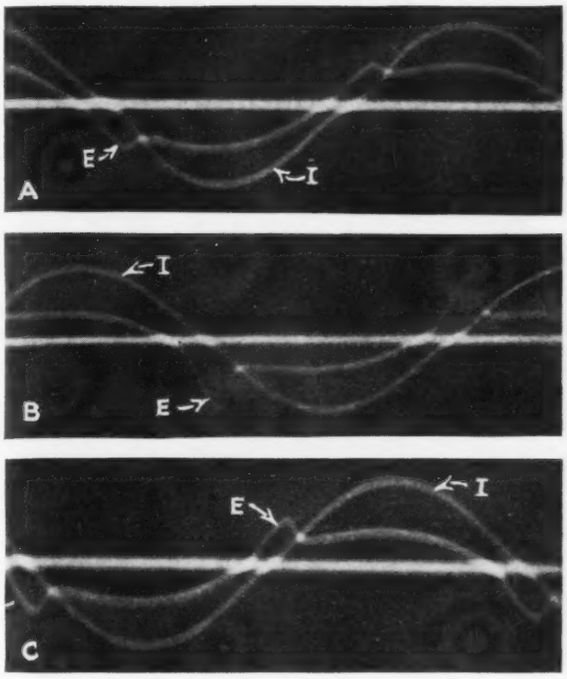


Fig. 3 a, b, c—Current and wave form with resistance box and transformer with and without series resistor

(a) With no external resistance in secondary circuit of loading transformer, note slight distortion of *I* and pronounced distortion of *E*. Latter has no importance in relay testing. (b) With 1-ohm in transformer secondary, note improvement in *I* and considerable increase in reflection of harmonics in *E*. (c) Using conventional resistance load box, note wave forms are similar to a and b.

after many consecutive tests and the average deviation was only 0.77 per cent for the entire test.

Although not absolutely necessary, it is recommended that an adjustable resistance of 0.5-2 ohms, capable of carrying the maximum test current, be inserted in series with the transformer secondary. For each value of test current the maximum resistance should be inserted and the transformer secondary voltage adjusted to the necessary value, followed by reduction of the resistance if necessary. Although there are several fine makes of adjustable resistors for this purpose, preference is given to a slide-wire type with screw adjustment for finer values, thus furthering flexibility of rapid and precise current value adjustment.

Comparison of the three accompanying oscillograms shows a close similarity of both current and voltage waves, so that, unless ultra-precise accuracy of testing is desired, it is optional whether the resistance box or adjustable transformer with or without series resistance is used, so far as accuracy alone is concerned. But for inherent flexibility and rapidity of precise application to testing methods the adjustable transformer with series resistance is recommended.

Besides being used for timing overcurrent relays, the adjustable transformer has general purpose applications. For example, certain types of under-voltage relays can be tested by connecting the transformer secondaries to buck the normal voltage applied to the relay in gradual steps. Many types of ratio differential relays can be tested when a slide-wire resistor is used with the transformer. Testing of relay selectivity appears to introduce no appreciable error, inasmuch as all relays are tested by the same method. In general, it is believed that cost of relay testing will be less with this method than with many other methods. Therefore, on the basis of acceptance tests and field experience the device has been adopted as standard for this class of work and has met with considerable approval from those who use it daily.

Comparison of Timing with Resistance and Transformer Loading

Relay Time Lever Setting	Current (Amp.)	Resistance Load-Box Time (Cycles)	Transformer with 0.4-Ohm Series Resistance Time (Cycles)	Differs from Load-Box by (Cycles)	Per Cent	Transformer with 0.2-Ohm Series Resistance Time Cycles	Differs from Load-Box by Cycles	Per Cent
1	15	98.0	99.0	1.0	1.0	100.0	2.0	2.0
1	20	55.0	55.0	0.0	0.0	56.0	1.0	1.8
1	30	36.8	36.8	0.0	0.0	37.5	0.7	1.9
1	40	30.6	30.7	0.1	0.3	31.1	0.4	1.3
5	15	477.0	479.5	2.5	0.5	482.0	5.0	1.0
5	20	250.0	251.0	1.0	0.4	251.0	1.0	0.4
5	20	154.0	154.0	0.0	0.0	154.4	0.4	0.3
5	40	121.5	121.5	0.0	0.0	121.5	0.0	0.0
10	15	1575.0	1580.0	5.0	0.3	1586.0	11.0	0.7
10	20	876.0	879.0	3.0	0.3	881.0	5.0	0.6
10	30	544.0	545.0	1.0	0.2	546.0	2.0	0.4
10	40	424.0	425.0	1.0	0.2	426.0	2.0	0.5

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Overspecification Not Always Justified

That overspecification is at times justified was brought out at the recent convention of the National Association of Purchasing Agents at Boston, Mass., in a paper by T. R. Harber, purchasing agent Kansas City Power & Light Company. The author defined overspecification as a stipulated requirement for strength, quality or appearance beyond a reasonable factor of safety to insure satisfactory performance, due consideration being given to available materials, articles and devices economically suitable to the purpose. As an illustration of justified overspecification the author mentioned an item commonly used in underground transmission and distribution, in which the company's requirements are in excess of standard commercial practice as to dimensions and finish, and which at one time could be secured only with difficulty. The cost is higher than for commercial standards, but the results secured justify the excess because the failures per thousand in the device in which the item is used are but 0.6, compared with a national average of 1.6. Failures of another item which the company overspecifies in comparison with generally accepted standards are at 1.8 per unit, against a national average of 5. "From the standpoint of economy alone," said the author, "we cannot justify these overspecifications, as the increased cost would pay for a large number of outages. On the other hand, it is impossible to evaluate public good will, which cannot be had if the service is unreliable."

One manufacturer specified a certain finish on one of his steel requirements, which, with other stipulations, made it a special product. He later discovered that the finish was of no consequence, because the factory was applying its own finish. Further investigation disclosed a stock steel near enough to other requirements to satisfy all necessities, and the saving was about one-third the cost of the item originally specified.

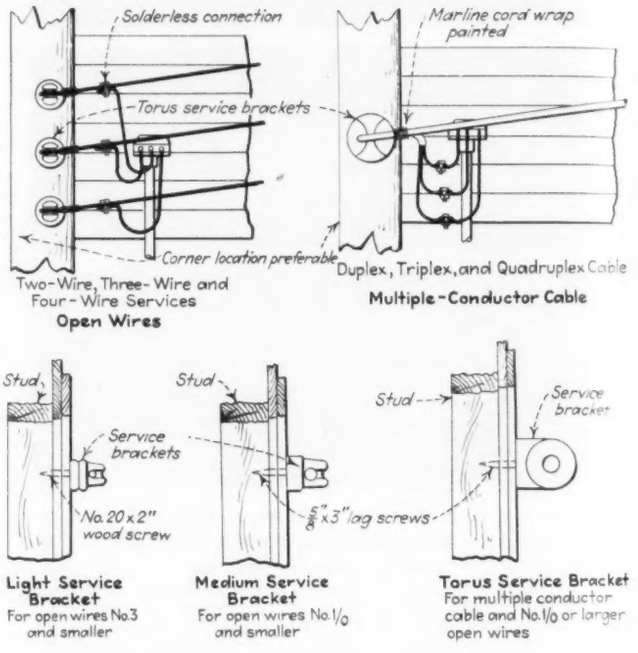
There are cases of overspecification which do not in-

crease first cost and result in little or no expense to the buyer, but which place a heavy burden of unanticipated expense on the seller. An instance is found in a former specification of a public utility covering an item extensively used and purchased in carload lots. The stipulations for finish added nothing to the cost of manufacture, but were so rigid that failure occurred frequently and the manufacturer was subjected to the additional cost of tests and transportation charges not contemplated when the sale was made. The purchaser sometimes lost by being forced to buy less than carload quantities of non-specification material from local stocks while awaiting replacement of rejected material. The stipulation added little or nothing to life or service.

A common error in specifications is to require specific manufacturnig procedure, thus not allowing the supplier to choose his own methods and materials to the best advantage for the desired results. This increases the cost to the purchaser and he receives no benefit from it. The cost of overspecification is also reflected when orders are made for special apparatus and an honest attempt has not been made to fit standard manufactured items to the job. Operating and construction men are sometimes tempted to overspecify in order to obtain their ideal, and, even the engineer is apt to err in this direction at times by his desire to prevent trouble in operation.

Lee J. Bussman, Bussman Manufacturing Company, St. Louis, Mo., concurred with the author that some engineers, possibly not entirely competent or not having time to check requirements, have simply made up specifications supposed to more than make certain of a satisfactory material or product regardless of cost. He stated that the buyer is actually spending money rather than investing it when he purchases something above his reasonable needs or beyond a reasonable factor of safety. In many instances overspecification is really incorrect design and entirely improper selection and treatment of material, considering available materials more in keeping with the requirements of the job. The purchasing agent must consider it his duty to challenge apparently incorrect and overspecified features just as he watches out for improperly designed and wrongly specified low quality items and parts.

Service Attachments to Wood Buildings



Attachment of service wires to wooden buildings has been greatly simplified by the development of a torus service bracket of dry-process porcelain, having a galvanized lag screw leaded into the porcelain, the New England Power Association has found. With duplex, triplex or quadruplex cable only one torus is required, but with open-wire services one torus bracket per phase is used. The brackets are screwed onto studs or similar beams of buildings. The larger sizes of bracket have openings for multiple-conductor cable. Service taps with drip loops are made by solderless connectors attached near the dead-end of the line close to the bracket.

To Maintain or Increase Earnings

Today there appear to be far more imperative reasons than ever before for really going into the business of home lighting and the natural growth method will have to be replaced with sound and aggressive methods. Newspapers have been announcing rate reductions to the residential consumer in a number of cities in recent months. These reductions are vital as far as earnings are concerned and executives will be confronted with the problems of maintaining these earnings.

This situation brings to the front more than ever before the untouched possibilities of the home-lighting market. It in itself holds the answer to this question if only the consumers' ability to buy is considered and this is important.

In selling better lighting we are in a superior position, for with it the uses of electricity can be increased with less initial expenditure on the part of the customer than with any of the well-known current-consuming devices with the possible exception of the electric flatiron. Several years ago one of the authors carefully analyzed this point and found at that time that the electric flatiron produced 94 cents in annual revenue for each dollar spent by the consumer to buy the iron. The results of our field research now show the average of all cases covered can produce practically $1 in revenue for every initial dollar invested by the consumer to correct his lighting conditions.

This is extremely significant, for it shows that the [Better Light – Better Sight] program fits the greatest number of pocketbooks.

E. W. COMMERY and MARY E. WEBBER

To 1933 convention of Illuminating Engineering Society.

Electric Heat for Humidity Control in Sugar Storage Warehouse

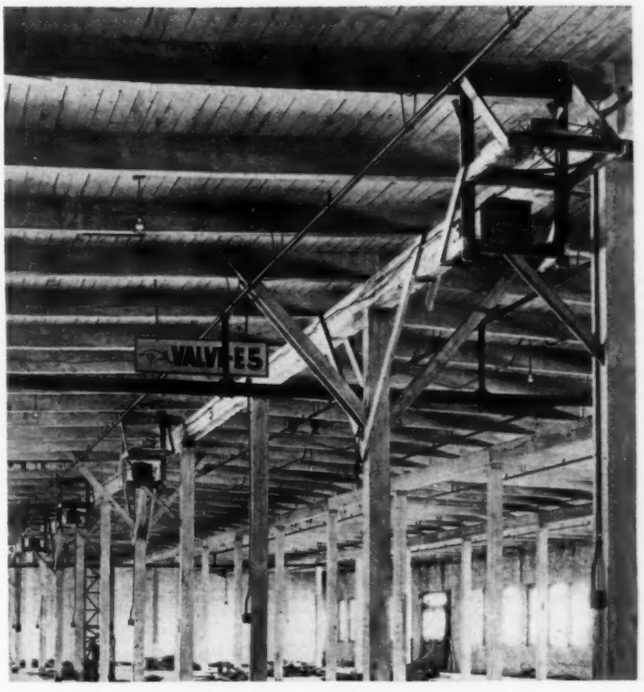
By DELTON T. WABY
Public Service Company of Northern Illinois, Chicago

WHEN the problem of humidity control in a sugar storage warehouse 120 x 300 ft. was first presented to the power sales department of the Public Service Company of Northern Illinois it was submitted as a 100 per cent heating problem. A survey of the requirements in the warehouse and results to be accomplished with electric heat indicated that this problem was not one of heat, but of humidity control. The requirements were analyzed from this standpoint and recommendations made as to the type of heating units best suited for the installation, number of units and their location. This installation was of a temporary nature and purely a trial to substantiate theoretical heating requirements indicated by an analysis of Chicago Weather Bureau reports, relative humidity necessary for safe sugar storage conditions and results accomplished in other warehouses where attempts have been made to provide 100 per cent sugar storage conditions.

The temporary installation in the warehouse consisted of four 12-kw. industrial type unit heaters, spaced at equal intervals down the center of the building. These unit heaters were controlled by means of hygrostats; this meaning that they would turn on only when the relative humidity was above the predetermined storage condition of 65 per cent. In view of the large space to be conditioned, it was necessary to install large circulating fans of the propeller type to obtain better air agitation in such a large space. The results of this temporary installation clearly indicated that in the Chicago area electric heat could successfully master this problem at an installation and operating cost comparable with other heat sources

Operating Data—Humidity Control in Crooks Terminal Warehouse

Date	Times Operated	Hours of Operation	Days Operated	Demand in Kw. of Heating Equipment	Kw.-Hr. Heating Equipment
10/13/32 to 11/10/32 11/10/32	6	120	10	35.2	2,000
to 12/ 9/32 12/9/32	1	6	2	25.9	130
to 1/9/33 1/9/33	5	142	10	35.3	2,830
to 2/9/33 2/9/33	8	205	16	33.2	4,060
to 3/9/33 3/9/33	0	0	0	0	0
to 4/10/33 4/10/33	9	192	16	34.6	4,060
to 5/11/33 5/11/33	2	38	3	28.8	770
to 6/ 9/33	1	24	2	28.8	680



when due consideration is given to the many advantages of electric heat in a storage warehouse.

As a result of experience obtained on the temporary installation permanent heaters were installed in another warehouse in the same group. This installation consisted of five 6-kw., three-phase, 220-volt industrial type electric unit heaters evenly spaced through the center of the warehouse. These heaters are mounted near the ceiling with a fan above each. The warehouse in which the permanent installation was made is smaller than that used for the trial installation, thus requiring less electrical capacity. Propeller type fans capable of moving 6,670 cu.ft. of air per minute were installed above each unit heater. The accompanying illustration shows this fan and heater installation.

At the present time this warehouse is used solely for sugar storage. The installation of electric heaters was approved by the Chicago Board of Fire Underwriters and the warehouse management has stated that this equipment is the safest for installations of this type. The warehouse management has further stated that electric heat would be the most satisfactory heat source for humidity control where inspection of the warehouse or its content can be made only at infrequent intervals. This has been the case with this particular installation. During the period October 12 to November 12 weather conditions were such that heat was required on six different periods. Although no meters were installed on the heating load, a conservative estimate of the energy consumption during this period is 2,000 kw.-hr.

The five unit heaters and five fans are controlled by three hygrostats. The control settings of the hygrostats are such that the two unit heaters and fans in the middle of the building operate first. This is accomplished by setting the hygrostat control at a relative humidity of approximately 62 per cent. The two end hygrostats controlling three unit heaters and fans are set at approximately 67 per cent relative humidity in order to obtain full effect of the two middle units before the three end units come into operation further to reduce relative humidity conditions in the warehouse. This method of control is employed to secure minimum maximum demand on the electric power system. A study of the maximum demand chart for the 30-day period above referred to shows that on one occasion the total heating load and the maximum warehouse load occurred at the same time. The maximum demand of the electric heating installation amounts to approximately 33 kw.

On November 11 an inspection was made of this heating installation with a sugar representative. He reported the sugar to be in excellent condition and during this period a study of the maximum demand chart for this customer indicated that the heating units had been in operation on six different periods. On one of these periods, which extended over approximately 43 hours, the customer became somewhat worried as to whether or not the heating units would eventually turn off. His worries were unfounded, however, as during this period extremely bad humidity conditions were reported by the Chicago Weather Bureau and heat was required in the warehouse over this seemingly long period of time. Recent inspections continue to show that the sugar is in excellent condition.

This installation has proved successful, and under average weather conditions, such as those experienced in the Chicago area, electric heat will successfully solve the problem of controlling humidity conditions in well-constructed sugar storage warehouses. Electric heat insures 100 per cent heat efficiency and thus a minimum of operating requirements on the installation. Electric heat eliminates a central heating plant with its attendant high operating cost in proportion to the small amount of heat actually required for humidity control. This installation is entirely automatic and eliminates the ever-present fire hazard problem with flame type equipment. By controlling the heat requirements through hygrostats only the required heat units are dissipated, and *only* when they are needed. No time is lost in starting a central heating plant or keeping such a central plant fired to supply heat for sudden hourly changes.

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Humidity Control Prevents A.C. Brush Disintegration

By ELLIS F. BRACKEN

Superintendent of Substation Maintenance, Commonwealth Edison Company, Chicago

The introduction, about seven years ago, of 60-cycle synchronous converters on the Commonwealth Edison system, especially those having alternating-current rings with high peripheral velocities, brought with it a type of trouble which had not (at least in Chicago) been experienced in the operation of 25-cycle converters. The older kinds of alternating-current brushes, made of a mixture of metals and carboniferous materials, produced so much destructive ring abrasion that they were replaced by brushes of the same general types but with better mixtures, having better brush life and causing less ring wear. Under ordinary operating conditions these new brushes were quite satisfactory with respect to ring wear and brush life, but it was found that on some occasions extremely rapid wear was developed and sometimes whole sets of alternating-current brushes were worn out in from 30 minutes to 1½ hours. The cause was at first unknown, but close analysis revealed that such troubles were in practically every case coincident with extremely low temperature conditions outside, which occurred particularly during the winter of 1932-33. This was brought to the attention of the representatives of brush manufacturing companies and from them it was learned that a major converting plant in Canada had experienced similar troubles under similar conditions. Further study and investigation followed on the part of both the Canadian company and Commonwealth Edison Company. It was found that when, as a result of very low temperatures outdoors, the moisture content of the air was reduced to lower than about 1.25 grains of water per cubic foot certain makes of carbon and metal composition brushes disintegrated rapidly. The various brush manufacturing companies have been informed of the peculiar characteristics of these brushes and are actively engaged in efforts to improve their products in order to eliminate such troubles.

Until the efforts are completely successful and all danger from low humidity is passed the Commonwealth Edison Company has adopted the practice of humidifying air in 60-cycle synchronous converter substations when the absolute humidity approaches to within 0.25 of one grain per cubic foot of the critical humidity conditions; that is, when the moisture content of the air gets as low as 1.5 grains per cubic foot. The first attempt in this direction was made by setting up an air spray paint brush and using it to blow water in the form of mist into the ring and brush structures of the converters. This method was at once successful in preventing the trouble. Owing to the inconvenience of using air spray paint brushes, better methods were devised for spraying water into the air delivered to the machines. In some instances domestic type humidifiers are set up underneath the machines and the mist sprayed up into the ring and brush structures. In other substations an electric motor-driven whirling disk is used to break the water into mist, and in another a high-pressure pump forces water to a number of spray heads and accomplishes the same purpose.

The mist dissipated into the air is most effective when converted into aqueous vapor. Because air at low temperature will not hold any considerable amount of such vapor, it was found advantageous in some substations to control the temperature of the cooling air delivered to the converters. For this purpose provision was made to recirculate a part of the heated air discharged from the machines and dilute the cold air supply with it. By this method full control could be exercised over the moisture content of the cooling air.

Although the necessity of maintaining uninterrupted service to customers is of first importance and prevention

of rapid deterioration of brushes is necessary to keep converting units in service, the conservation of brushes is by no means to be ignored. When it is remembered that a complete set of ring brushes for a 3,900-kw. synchronous converter costs from $500 to $600, the possibility of their rapid disintegration on a large number of converters amply warrants the small expense of providing the necessary moisture content in the cooling air on the relatively infrequent occasions when extremely low temperatures produce unfavorable humidity and contact conditions.

A careful study on the life of direct-current brushes as affected by humidity conditions is in progress, and although direct-current brushes are thoroughly stable and not subject to rapid disintegration when the moisture content is low, it is found that in extremely dry air their rate of wear is considerably increased. This study is as yet incomplete, and while the tendency has been well established the rate of increase is not yet determined.

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Response of Crops to Electric Light

Effect of wavelength on aster

By ROBERT B. WITHROW

Purdue University Agricultural Experiment Station, Lafayette, Ind.

LOW light intensities such as produced by a 15-watt lamp, applied at night as a supplement to daylight, increase flower production and earliness in flowering of certain crops about as favorably as higher intensities, such as from a 500-watt lamp. The blue end of the spectrum, supplementing normal daylight, inhibits growth with pansy, stock and aster. The red end accelerates and the yellow-green affects flower production and stem length less than either of these. Often a short period of irradiation applied at the right stage in development produces as great an increase in flower production, stem length and earliness in flowering as much longer periods. There is very little difference in results obtained by lighting at different times of night for five- and ten-hour periods.

Of a miscellaneous group of plants subjected to a 100-watt lamp applied for ten hours each night, Shasta daisy, perennial Gaillardia, Scabiosa, nasturtium, eight varieties of asters and dahlia were among those that gave the most outstanding results with earlier flowering or increased flower production, or both. Those plants which have been bred to give good yields during the short winter days have not, in most of the cases studied, produced very marked increases due to added light.

Stage in Development to Apply Irradiation.—Pansy, stock and Heart of France aster were subjected to additional light at different ages. Forty days of irradiation over pansy gave better results when applied during the earlier stages of life, rather than later. With stock, light applied late in the life of the plant did not increase the stem length so decidedly as light applied earlier, and additional light during maturity caused the plants to become weak stemmed. Thus it appears that the best results with stock may be obtained by lighting from the period of seedling growth until flower buds just begin to appear.

Aster plants irradiated the first 40 days of life blossomed well ahead of the other groups. Those lighted the second 40 days were next to flower, while those lighted their entire life blossomed only a few days later. The longest stems and the largest flowers were on plants irradiated for their entire life. A large percentage of abnormal flowers were present in the 40-day plots and the controls.

Time and Duration of Irradiating Period—In the case of pansy, continuous illumination produced the greatest increase in flower ratio and stem length over the control. Stock gave the longest stems when subjected to a ten-hour period, 9 p.m. to 7 a.m., at 16 ft.-candles and 8 ft.-candles. There was scarcely any difference between these two as to stem length and time of flowering. With aster, the ten-hour plot at 8 ft.-candles gave the earliest flowers, as well as decided increases in stem length and flower diameter. In the case of pansy, stock and aster the most economical lighting is the five-hour period at 16 ft.-candles, which, in almost every case, gave about as great an increase in flower diameter and stem length as did the ten-hour period at 16 ft.-candles. Further experimentation will be required, however, to determine whether five hours is a sufficient period for the lower values of intensity.

The final test of any commercially practical process is the extra cost involved, which in these studies largely

**Excerpts from a paper presented before the Illuminating Engineering Society on results of a study conducted in co-operation with the Utilities Research Commission, Chicago.*

resolves itself down to power consumption per marketable flower. With pansy, using a power consumption of 1 watt per 2 sq.ft. of bench space to produce a light intensity at the bench of ¾ to 1½ ft.-candles, applied for ten hours each night for nearly three months, the power consumption was 0.9 kw.-hr. per 100 flowers. At 5 cents per kilowatt-hour this is a cost of less than 4½ cents per 100 blooms, this expense being incurred to increase the normal flower production eight times. Pansies sell wholesale for $1 to $1.50 per 100 blooms during the spring.

With aster, under similar conditions of irradiation, the power consumption per 100 flowers was 3.3 kw.-hr., which at 5 cents per kilowatt-hour is 16.5 cents. Asters during the early summer season have a wholesale price as high as $3 per 100 blooms.

When it is considered that the aster is one of the florists' best cut flowers, coming in a wide variety of colors, forms and sizes, and stands up very well in shipping and in the home, this flower alone assumes a place of considerable importance as a potential crop during the winter months when there is a dearth of such flowers available to the florist.

Table I—Effect of Supplementing Daylight with Artificial Radiation of Various Intensities

The lower intensities produced just as desirable results as the higher ones, and further, with pansy, produced better quality flowers.

Seeding dates: Pansy, July 29, 1932; stock, Dec. 28, 1932; aster, Oct. 2, 1932. Irradiated: Ten hours nightly from 9 p.m. to 7 a.m. on the following dates: Pansy, Oct. 7—Dec. 29, 1932, for 83 days. Stock, Jan. 10—April 15, 1933, for 95 days. Aster, Oct. 14—March 20, 1933, for 157 days.

	Pansy			Stock		Aster			
Foot-Candles	Av. No. Flowers per Plant	Flower Ratio	Av. Stem Length, C m.	Av. Stem Length, C m.	Decrease in Time to Flower, Days	Av. No. Flowers per Plant	Av. Flower Diameter, C m.	Av. Stem Length, C m.	Decrease in Time to Flower, Days
1½	13.3	8.3	6.2	76.25	5	4.9	8.3	18.9	39
4	16.2	10.1	6.3	81.1	5	6.2	8.5	22.5	33
8	13.3	8.3	6.8	83.4	5	5.2	8.5	26.4	39
16	11.4	7.1	6.0	84.0	5	5.0	8.4	26.8	33
110	16.5	10.3	6.2	79.6	11	5.1	8.4	26.3	33
Control*	1.6	1.0	6.4	82.75	..	9.0	5.6	18.8	..

*Natural lighting only

Table II—Effect of Supplementing Daylight with Artificial Radiation of Various Wavelengths

Plants having the full radiation of a "Mazda" lamp at 4 ft.-candles gave, with pansy, a greater number of flowers, and longer stems; with stock, longer stems; with aster, larger flowers and longer stems, than either the filtered plots or control plants. Seeding and irradiation as noted in Table I

	Pansy			Stock			Aster			
Wavelength Angstrom Units	Av. No. Flowers per Plant	Flower Ratio	Av. Stem Length, Cm.	Av. Stem Length, Cm.	Av. Fresh Weight, Gm.	Av. Dry Weight, Gm.	Av. No. Flowers per Plant	Av. Flower Diameter, Cm.	Av. Stem Length, Cm.	Decrease in Time to Flower, Days
Red..... 10,000-6,400	9.0	5.6	6.1	80.5	69.0	7.27	5.8	6.3	12.8	33
Yellow-green .. 6,200-5,000	4.2	2.6	5.3	76.75	66.0	6.77	11.5	5.9	15.5	10
Blue-violet.... 5,000-4,000	4.1	2.6	5.4	74.25	60.6	5.95	6.2	5.4	8.7	39
"Mazda" lamp unfiltered 4-ft.-candles.....	16.2	10.1	6.3	81.1	78.7	9.09	6.2	8.3	22.5	33
Control*.....	1.5	..	5.6	72.75	66.5	6.26	10.1	5.4	19.9	..

*Natural lighting only.

Table III—Effect of Supplementing Daylight with Artificial Radiation on Certain Greenhouse Crops

Irradiated at 16-ft.-candles ten hours each night, with further experimentetion the kw.-hr. per 100 flowers may be reduced as has been done with aster and pansy.

Plant	No. of Days Irradiation	Increase in No. Flowers, Per Cent	Increase in Stem Length, Per Cent	Decrease in Flowering Time, Days	Kw.-Hr. per 100 Flowers
Calendula.....	65	.....	43.1	..	52.0
Carnation (pink abundance)....	176	25.3	12.2	..	30.0
Chrysanthemum burridgeanum.	147	226.8	86.7	33	19.0
Dahlia (Papillon).....	157	669.2	177.0	28	272.0
Daisy (Shasta Alaska).....	135	154.6	6.2	22	57.0
Didiscus coeruleus.....	119	63.5	.....	45	27.0
Gaillardia grandiflora (Portola Hybrids).....	129	375.0	138.3	11	76.0
Marigold (Legion of Honor)....	54	41.5	.....	..	2.5
Nasturtium (Golden Gleam)...	111	107.5	.....	..	10.0
Scabiosa (amethyst).....	147	Control did not blossom until after close of experiment		78	29.0
Snapdragon (Suntan).....	140	80.8*	.....	15	46.0
Snapdragon (Rose Queen).....	120	235.0*	.....	19	30.0
Sweet Pea (Ball's Rose winter flowering).....	164	30.7*	20.9	..	22.0
Sweet Pea (Pinkie) (summer flowering).....	164	Control had not blossomed on March 20, at close of experiment			

*Flowering stalks.

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Lamp Sales Respond to Lamp Inspections

By M. W. ROSS

Lighting Sales Department
*Commonwealth Edison Company, Chicago, Ill.**

In 1932 the Commonwealth Edison Company used a crew of six men, carefully trained in lamps, home-lighting. lamp-renewal policies and merchandising policies, to make a systematic solicitation of all residential customers to replace burned-out lamps and fill empty sockets. They found little opposition on the part of customers to use the correct lamps and to fill their sockets. The principal reason for the lack of sufficient lamps found in most homes was either because customers did not know of the company's lamp-renewal policy or simply neglected to order new lamps. In that year 13,903 customers were sampled. Orders were received for more than 98,000 lamps, a total wattage of 5,674 kw.

This year the company expanded this service, now using fourteen men. The salesmen are employed primarily to renew lamps, but have the privilege of selling and introducing special items of lighting equipment and other merchandise. They carry "Pin-It-Up" lamps or some such item which will introduce modern equipment. The salesmen employed are strictly on a commission basis.

For the first six months of 1933 these men secured 49,673 orders for a total of 367,638 lamps. This is an average of 7.4 lamps per order and represents a total wattage of 21,864 kw., of which 6,670 kw. went immediately into inactive sockets. These lamps were divided as follows:

Size of Lamp, Watts,	No. of Lamps	Per Cent of Total	Size of Lamp, Watts,	No. of Lamps	Per Cent of Total
10	1,767	0.52	100	38,478	11.20
15	2,879	0.85	150	1,159	0.33
25	19,188	5.55	200	786	0.23
40	4,322	1.10	300	70	0.02
60	278,687	80.20			

These men often find several lamps burned out in ceiling fixtures and portables. There are also many

*From paper to 1933 convention of Illuminating Engineering Society.

empty sockets which have not been filled for a long time. Some customers stated that they had not replenished their lamps for as long as two years. In the company's lamp schedule 100-watt lamps are furnished as part of the rate at no additional cost. In spite of all the publicity given this subject, it was found that about 25 per cent of the customers did not know the lamp-renewal policy. When personally informed they were glad to accept 100-watt lamps for kitchen, basement and garage use. Many kitchen units originally furnished with 100-watt lamps were found with 60 watts. By personal solicitation they are easily brought back to their correct wattage.

Most customers appreciate this service, particularly old people who find it hard to get to the lamp-renewal stores. People who wish to have new lamps are glad to be reminded of it. The men engaged in this work serve as personal contact for the company and are able to answer many questions put to them by the customers. While soliciting lamp renewals they are able to talk about electrical merchandise, either completing the sales or turning leads over to other departments.

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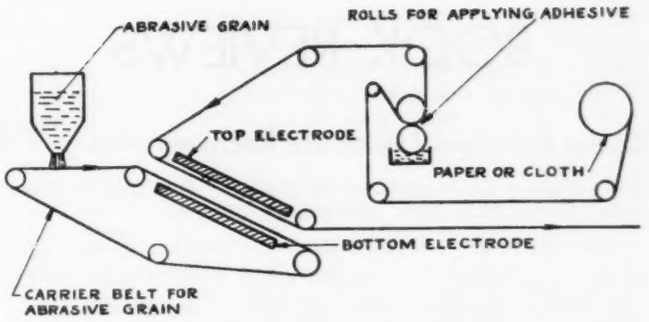
Electrostatic Process Improves Sandpaper

Electricity is now used in the manufacture of sandpaper and gives a product showing great improvement over sandpaper made by other methods. Tests carried out under actual working conditions show that this new product has an increased working efficiency from 30 to 40 per cent above previous sandpapers, with a saving in time and effort and lasting longer.

The new process employs an electrostatic field for applying the coating to the glued surface of the backing. The ordinary 220-volt alternating-current supply is stepped up by a variable high-tension transformer to the voltage required by the process, which varies from 20,000 to 100,000 volts. This current is rectified by means of vacuum tube-rectifying equipment and transmitted to the electrocoating machine as a unidirectional current. The electrocoating machine has two electrodes or condenser plates. These are charged by means of the high-voltage, unidirectional current and an intense electrostatic field set up between them.

The abrasive particles, first graded and sized, to suit the particular sandpaper that is to be made, are conveyed into the field on the upper surface of a conveyor belt which passes over the lower, or negative, of the two electrodes. At the same time the cloth or paper backing material is passed below the upper, or positive electrode, with its glue-covered surface facing down. As the abrasive grains enter the field they become electrically charged. Due to their elongated or splintery character, the electrical charges become concentrated on the ends of the particles, that is, the particles are polarized. The reaction between the field caused by the charge in the particles and the field between the electrodes causes the particles to become oriented so that their long axes are parallel to the lines of force of the field between the electrodes.

As a result of this orientation, which places the positively charged end of each particle adjacent to the negative electrode, the particles lose their positive charge, retaining only the negative charge. This has two results: First, the particles mutually repel each other, so that they assume an approximately uniform spacing; second, electrostatic repulsion between the negatively charged particles and the negative electrode causes the particles to move toward the positive electrode. Before reaching this electrode, the oriented grains are intercepted by the adhesive-coated paper in such a way that the grains adhere to it in upright and evenly spaced position.



How electrostatic process was applied to making sandpapers

Advantages of coating sandpaper in this manner come from the fact that the coating has a working surface composed only of the sharp, cutting points of the grains and that these points are evenly distributed over the surface. This makes it cut more smoothly and quickly than sandpaper made by other methods and also causes it to last longer in service.

The process is being used by the Armour Sand Paper Works, Chicago; Behr-Manning, Corporation, Troy, N. Y.; the Carborundum Company, Buffalo, and the Minnesota Mining & Manufacturing Company, St. Paul.

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READERS' FORUM

Rotation Timing Check Not New

To the Editor of the ELECTRICAL WORLD:

Messrs. Newman and Minikes' method of checking polyphase meter connections (ELECTRICAL WORLD, page 204, August 12, 1933), while simple and positive, cannot be called new. A system practically identical with this, but applicable to indicating and graphic instruments as well as to watt-hour meters, was developed by H. S. Baker of Niagara Falls, Ont., about 1909 or 1910, and since then has been widely used throughout the Province of Ontario.

Upon this method of "right-and-left readings" has been based a whole system, whereby may be determined not only the accuracy of wiring of the installation, whether three-wire or four-wire, and whether of balanced or unbalanced load, but values of power factor and reactive component on such loads. In fact, by the intelligent use of a few such readings it is possible to visualize the whole load with practically no use of trigonometrical terms, and to make an analysis of load conditions which might otherwise require the use of cumbersome and confusing formulas.

Waterbury, Conn. **PERRY A. BORDEN.**

BOOK REVIEWS

Labor Relations Under the Recovery Act

By Ordway Tead and Henry C. Metcalf. Published by Whittlesey House, New York. 259 pages. Price, $2.

The National Industrial Recovery Act seems to spring from the premise that property can stand loss by financial penalty legally imposed (temporarily can, anyhow); life at or near the margin of subsistence cannot. Thus recovery from depression demands that business yield to labor the same tokens of representative government in the economic field that have been accorded the citizen in the political field. Really, NIRA, NRA and the codes are harbingers of an industrial democracy with a new economic constitution. So do the authors philosophize about the remote import of the act.

They say the master-servant era has definitely gone and with it the submissiveness, docility, gratitude and spasmodically irruptive complexes of the worker. They firmly believe those negative attributes, fundamentally as impotent as the spirit of a corpse, can be converted into *esprit de corps, élan* or comparable exuberances that will elevate our whole industrial tone if only industry will foster collective bargaining (meaning the national union) or some form of employee representation. The *modus operandi* of various employee representation plans are outlined and typical defects emphasized and corrected.

The "new deal" promises that labor shall get a greater share of the fruits of industry. Insurance of this will derive from guaranteeing a greater participation in every step of the productive process. A good case is made for the company union in its various forms. But the act imposes high responsibility on the industry trade association. There must be a corresponding integration of the labor elements within a whole industry. The authors call the company union merely a transition to the trade union, ultimately working in equality with the trade association in a trade council.

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Business Under the Recovery Act

By Lawrence Valenstein and E. B. Weiss. Published by Whittlesey House, New York. 314 pages. Price, $2.50.

Even if the recovery act is only 30 per cent successful in accomplishing its announced objectives it will have proved so effective in profoundly remodeling American wholesale and retail business as to become a permanent component of our laws. Rugged individualism has vanished and in its place there will be self- and government-regulation of industry not so far different in principle from federal regulation of railroads and state regulation of utilities. The Federal Trade Commission has been a farcical effort in this direction. But, being competitive, industry can safely be intrusted with a large share of its own regulation. Germany went cartel in the depression which followed its conquest of France in 1870. Cartels have survived Kaiserism, a World War, a republic, dizzy inflation and even a Hitler. The NRA is construed by the authors to be a democratized form of cartel calculated to save us from both Communism and Fascism.

But the main theme of the book is that the prominence given to the trade associations and their codes will eliminate many, but no one expects all, of the abuses which have been the despair of business. The origin of many of these destructive practices is traced, their effect on ethical conduct, profits, stability and on the big and little unit analyzed to ascertain the likelihood of successful elimination under the act. As this business socialism wards off state socialism several, and maybe more, of the following unfair practices will pass under scrutiny, restraint and proscription: Fake invoices, price juggling, espionage, inferior merchandise, misrepresentation, sales baits, loss leaders, secret rebates, Hollywood testimonials, returned goods, piracy of designs, consignment selling, etc.

From this array it is evident that purification of trade practices is the main theme of the book, with secondary emphasis on profitableness. The small, independent merchant, the authors believe, will revive to become an attractive outlet for thousands of manufacturers and the chains will be correspondingly reduced in potency for evil. Quality and truth will prevail in advertising as well as in display and selling.

Appendices present the act in full, the statements of the President and Administrator Johnson interpreting its objectives and enforcement, and the dry goods and textile codes in full.

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Technical Report for 1932

Published by British Engine Boiler & Electrical Insurance Company, Ltd., London. 202 pages, 141 plates. Price, 7 shillings 6 pence.

Familiarly known as the "British Engine," this annual reports that modern oil engines, motors and boilers occasion the major portion of the 10 per cent of its losses due to mechanical failures. Plain carbon steels contribute more failures than specially heat-treated steels and alloys. Many cases of failure of crankshafts, motor shafts, welded repairs, etc., as well as of boiler drums and tubes, are exhaustively analyzed, metallographically and otherwise, to solve obscure causations. A considerable section is devoted to fusion welding, technique for test specimens, effect of heat treatment of welds and of the manganese, sulphur and phosphorus content. A detailed summary of the facts about 60 boiler explosions in 1931 reveals more than is commonly published in this country about such happenings.

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Bulletin of the National Research Council

Compiled by Clarence J. West and Callie Hull. Published by the National Research Council of the National Academy of Sciences, Washington, D. C. 223 pages. Fifth edition. Price, $2.

This fifth edition reports details of staffs and research activities of 1,562 industrial and consulting research laboratories of the United States. Of these 150 or more are distinctly electrical and at least 60 more have to do with cognate problems. A most valuable aid to prevention of duplicated effort and encouragement of co-ordinated action in research. Of course, any of these researches are private efforts to control processing, perfect new designs, etc., and to support confidential consulting services, but many, too, are of the publicizable character.

Men of the Industry

I. H. SCLATER has been appointed engineer of the power transformer engineering department of the General Electric Company, Pittsfield Works. Following graduation from Virginia Polytechnic Institute, Mr. Sclater entered the employ of the General Electric Company at Lynn, Mass., in 1906, in the testing department for distribution transformers. In 1913 he was transferred to Pittsfield, in the distribution transformer department, and from 1916 to 1926 was head of that section. Then he engaged in instrument and power transformer design and previous to his new appointment was assistant engineer of the power transformer department, in charge of transformers from 501 to 7,000 kva. Mr. Sclater is a fellow of the American Institute of Electrical Engineers.

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J. W. OWENS has been appointed consulting engineer and director of the newly organized national weld testing bureau of the Pittsburgh Testing Laboratory, Pittsburgh, Pa. The bureau proposes to render a complete welding service to manufacturers, fabricators, contractors and corporations. Mr. Owens has been active in the welding field for fifteen years. He is a member of several committees of the American Standards Association and of the American Welding Society, having also served the latter organization as its vice-president 1920-22. He is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers.

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A. L. KIMBALL, who has been connected with the staff of the research laboratory of the General Electric Company at Schenectady, has been transferred to the engineering general department of the company. In his new position Mr. Kimball will be associated with A. R. Stevenson, Jr., and will assist all design engineering departments of the company on problems involving ventilation, vibration and noise, co-operating closely with the laboratories. Succeeding Mr. Kimball, E. L. Thearle, who has been identified with the General Electric Company since 1928, will direct the activities of the mechanical research section of the research laboratory.

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GRANT B. SHIPLEY of Pittsburgh, Pa., has resigned as president of the Wood Preserving Corporation, Century Wood Preserving Company, National Lumber & Creosoting Company and the Carolina Wood Preserving Company and has been elected chairman of the board of directors of the Wood Preserving Corporation. ARTHUR W. ARMSTRONG, executive vice-president of these companies and president of the Ayer & Lord Tie Company of Chicago, has been named president of the wood preserving companies.

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OBITUARY

Charles W. Tippy

Charles W. Tippy, a vice-president of the Consumers Power Company, Jackson, Mich., and general manager of the company since its organization in its present form in 1914, died September 15 at his home in that city, following injuries sustained in an automobile accident. Mr. Tippy's early experience in the public utility industry was in the gas supply field. It was not until 1912, when he went to Detroit as assistant to W. M. Eaton in the management of the electric properties of Hodenpyl, Hardy & Company in Michigan, that he became associated with electric light and power service. Mr. Tippy was born in Three Oaks, Mich., in 1876 and was graduated in 1899 from Purdue University. He was active in association work, being a past-president of the Great Lakes Geographic Division of the National Electric Light Association.

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AUGUSTINE R. EVEREST, consulting engineer for the British Houston Company, Ltd., Rugby, England, died July 15 in his sixty-eighth year. Mr. Everest came to this country early in his career and entered the service of the Thomson Electric Welding Company, Lynn, Mass. In 1896 he joined the Thomson-Houston Company, being engineer in charge of the alternating department for several years. In 1905 he returned to England to affiliate himself with the engineering staff of the British Thomson-Houston Company, Ltd. Up to the time of his appointment in 1914 as consulting engineer to the engineering and manufacturing departments of this company at Rugby Mr. Everest had been designer of a.c. apparatus and also had acted as chief adviser in regard to special tests and investigations relating to insulating material. He was one of the most active workers on the British Standards Institution Committee of the British Electrical and Allied Manufacturers' Association and was active in the work of the International Electrotechnical Commission, and also on committees of the Electrical Research Association. He was also a member of the Institution of Electrical Engineers, the Faraday Society and the American Society for Testing Materials.

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New Equipment Available

Cathode-Ray Oscillograph

Cathode-ray oscillograph designated type HC-10-Bl, for the study of recurring waves from power frequencies to several million cycles per second, has been announced by the General Electric Company. The complete oscillograph requires only 200 watts and can be operated from any 100-volt, 50- or 60-cycle source. The complete oscillograph equipment consists of two units, the cathode-ray oscillograph and the time-axis oscillator.

In the cathode-ray oscillograph unit the cathode tube is fastened horizontally on the top of the power-supply housing by means of an adjustable bracket. The tube is within a sheet-iron holder, in a socket mounting fastened to one of the brass end covers. This sheet-iron holder provides electrostatic as well as magnetic shielding. Within the power-supply housing are mounted the necessary filament transformers, a high-voltage transformer and the rectifier tube and capacitors for operation of the cathode tube at 3,000 volts.

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Compact Draft Regulator

Need for a compact draft regulator for boilers up to 200 hp. and designed along sound engineering lines has been apparent for some time. The Carrick Engineering Company, Michigan City, Ind., now offers a device for this service after two years of laboratory and field development work. The new regulator is designated as the Carrick Type HF-1 and is identical in fundamental design with the Type HF-2. It contains, however, certain modifications of design which make it applicable to small and medium-sized boilers. The regulator can also be used to control fan speed for ventilating system pressures or

drafts. The regulator is of the hydraulic type, contains no diaphragm and operates on the principle of a beam scale on which the predetermined draft is set.

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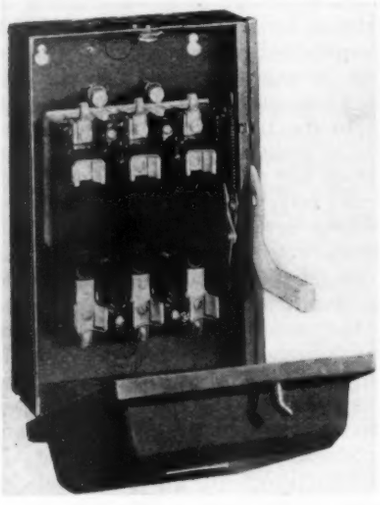
Compact Switches With New Features

Large inside, small outside expresses the major features of a new line of compact switches announced by the Square D Company, Detroit, Mich. While the cabinets of these switches



have considerably smaller external dimensions, the arrangement of the base permits the entire area of the back of the box to be used for wiring. This is accomplished by the elevation of the base from the back of the box by means of four mounting posts, allowing ample room for wires. These switches have a complete interlock, quick make and quick break and a double-break method.

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A 50-AMPERE TYPE F portable phantom load has been announced by the States Company, Hartford, Conn. Some of the advantages are: The all-binding posts have non-removable knobs; the primary switch is supplied instead of a plug; a fuse terminal is supplied in the primary lead; the loading steps of the load are 0.1, 0.2, 0.5, 1, 2, 5, 7.5, 10, 15, 25, 35 and 50. The current values are obtained by simply turning the dial switch on top of the load to the position indicating the current desired.

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SUITABLE FOR BALANCING the smallest fractional-horsepower motors and other forms of small rotating parts, the Olsen "Vibro-electric" self-indicating static-dynamic balancing machine, type E-O, has been announced by the Tinius Olsen Testing Machine Company, Philadelphia, Pa. It will indicate unbalance to as close as 1/10,000 ounce inch in balancing small rotors and is provided with resistances so that four ranges of sensitivity in readings may be obtained, depending on maximum unbalance to be indicated. All readings for amount of angle of unbalance may be taken in a single run and in one continuous operation.

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Industrial Lubricants With High Film Strength

Industrial lubricants which have unusually high film strength due to a special polymerization treatment have been announced by E. F. Houghton & Company, Philadelphia, Pa. Known as "Sta-Put" lubricants, they are made of pure mineral oil which is polymerized under carefully controlled heat and pressure. This treatment results in a complete rearrangement of the molecules of the oil without any change in its chemical content, thus producing a much closer bond between all of the molecules and a consequent increase in film strength.

Tests indicate that this treatment increases the film strength of these oils 40 to 65 per cent. In addition, they cling to the bearing surfaces and do not drip or spatter as easily as ordinary mineral oils. "Sta-Put" lubricants are made in three series and are available in grades for nearly every type of industrial equipment.

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Start-Stop Push-Button Station

An improved start-stop push-button station is offered as standard equipment by the Square D Company, Industrial Controller Division, Milwaukee. The push buttons are extra large—1 in. diameter. The buttons and stems are molded of bakelite in one piece and are supported by strong compression springs with an additional follow-up spring at the contacts. The contacts are silver to silver, double break. The mechanism is mounted on a porcelain base and is removable as a unit from the inclosure. The designation is Class 9001, type B20. This station is also built with dust-tight and water-tight inclosure.

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COMBINATION HANGER and wall outlets for kitchen and other type wall clocks, recently announced by the General Electric Company, have overcome a common objection put forth by many electric clock owners. Prior to the introduction of this product it was necessary to run a wire across the wall from the clock to the convenience outlet. The new hanger and outlet will permit a neat installation with no wires showing.

Clip-on Ammeter

A new model clip-on ammeter which instead of being supplied in the single combination of 0/100 and 0/500 amp. can be furnished with single or dual ranges in any combination of from 7.5 to 1,000 amp., the first point on the scale in each case being 10 per cent of full range, has been announced by Ferranti, Inc. The handle of the instrument is insulated from a bare copper conductor placed in the window of the magnetic circuit for 15,000 volts, so the meter may be used with safety as well as convenience and accuracy.

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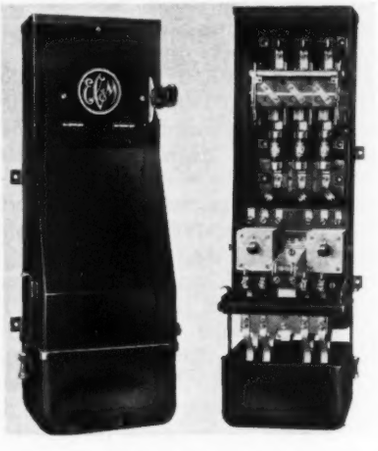
Across-the-Line Combination Magnetic Starter

For motors up to 15 hp., 220 volts, and 30 hp., 440-550 volts, the Electric Controller & Manufacturing Company, Cleveland, Ohio, announces the type ZOS oil-immersed, across-the-line, combination magnetic starter, containing an unfused or fusible safety switch, a magnetic starter with overload relays and heavy-duty test jacks for those applications where it is desired to insert meters in the motor circuit without interrupting the operating of the machine. Although designed for the severe service encountered in mill duty, these starters are exceptionally small and narrow, having safety switch front operated and a cover that swings vertically.

Heavy-duty, extremely sturdy construction is used throughout these



starters. Safety switches have wiping wedge, double-break contacts, heavy gage steel parts with all actuating parts case hardened. Magnetic starters have bushed arm bearings, highly efficient magnetic circuits, making them exceptionally quiet in operation, larger-than-average clearances between live parts and high arc-rupturing capacity. Overload relays are accurately designed to provide sensitive overload protection and have high heat inertia to withstand heavy overloads.